User Manual

go2DECODE 3.4

by PLATH AG, Switzerland

Imprint

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General

Welcome to go2DECODE

go2DECODE is an extremely efficient software product whose major functions are to recognize modems and to analyze signals in various fields of reconnaissance. Modems (as combinations of demodulator and decoder) are the central items in the automatic recognition process.

The analysts' knowledge and experience are employed to compile modems and modem lists for automatic recognition, i.e. the system is knowledge-based software.

Go2DECODE provides numerous functions, such as:

- Modem identification
- Demodulation and decoding of detected modems
- Technical analysis of communication signals
- Receiving and recording of emissions
- Monitoring of specific frequencies
- Monitoring of communication networks

This wide range of functions makes it a powerful tool for a great variety of applications. Since this approach is based on profound knowledge, go2DECODE allows for fully automated identification and production of modems which are included into the system by the user only once. This provides optimum relief to the operator in the daily routine with minimum initial effort. The close link between demodulator and decoder will minimize the identification error rate.

Comprehensive analysis tools allow the manual extraction of technical parameters of unknown and new modem types in order to include these into the knowledge base for future automatic processing.

The individual software modules communicate via LAN, i.e. every module may run on its individual hardware and transfer the data to the other modules (which is the common procedure in large-scale multi-channel systems), if required by the application. go2DECODE thus provides the option to use detached receivers, to process unknown signals and to supervise the routine work in other locations or on independent hardware. In the existing stand-alone system, all functional units are applied on one individual hardware unit.

The software modules are neither platform nor operating system sensitive, i.e. they run on any commercial standard hardware (COTS) under any standard operating system (Windows® und Linux®). Since the modules do not depend on specific hardware, the use of new and more efficient hardware generations will increase the performance of go2DECODE by simple means.

Due to the high modularity with TCP/IP-based data interchange via LAN, go2DECODE and its individual components can be integrated into existing systems, or adapted to new tasks in a quick and simple way. Some of the demodulators and decoders in new modems can be interchanged, This facility ensures that the system can be employed in varying scenarios. The adaptability of go2DECODE to future technology trends guarantees a maximum life cycle and a safe investment.

Note:

Please find information about the actual version in the readme file.

The described functions are subject to the delivered version.

Any requests and suggestions about go2DECODE will be highly appreciated. We are happy to receive your information via the support contacts stated below.

go2SIGNALS

go2SIGNALS

The use of radio communication is constantly rising. The traditional approach of monitoring this more and more connected signal scenario with a manual approach of channel stepping and manual search is not promising for future challenges.

The product line go2SIGNALS covers customer requirements from traditional manual signal handling to fully automatic intelligence system. This provides processing speed and user comfort of automatic intelligence systems to single user working positions. It is the perfect solution for mobile, stand-alone and remote controlled applications as well as a start into the world of automatic monitoring.

The focus of go2SIGNALS is on radio monitoring. Future products will also provide some parts of Communications Intelligence (COMINT) or Signal Intelligence (SIGINT).

go2MONITOR

go2MONITOR is a modular software solution for receiver control, classification, demodulation, decoding and recording of HF, VHF, UHF signal.

go2DECODE

go2DECODE is a standalone software for signal recognition, demodulation, decoding, speech detection, signal recording and technical signal analysis.

go2ANALYSE

go2ANALYSE is a bit stream analysis software for manual determination of code characteristics.

go2RECORD

go2RECORD is a powerful integrated solution for monitoring, recording and extraction of wideband signal scenarios in a user-friendly and interactive way.

Introduction to go2DECODE

Short Description of the Programs

go2DECODE is built of the following functional units:

- APC (**A**utomatic **P**roduction **C**hannel)
- SDA (**S**ignal **D**isplay & **A**nalysis)
- DANA (**D**igital **AN**alogue **A**udio Interface)
- SOMO (**SO**ftware **MO**dulator)

On the one hand, the perfect coordination between the software modules SDA, APC and DANA increases the efficiency of go2DECODE. On the other hand, each of these modules will operate perfectly on its own.

Figure 1 provides a functional overview of the software modules SDA, APC, DANA and SOMO, in combination with a selected range of potential signal sources.

The lower section of the figure shows potential signal sources, which are either linked internally to the sound card of a computer (SOMO, any type of software player), or delivered to the system via the analogue input of the sound card (line-in, base band output of any receiver (see central left section)).

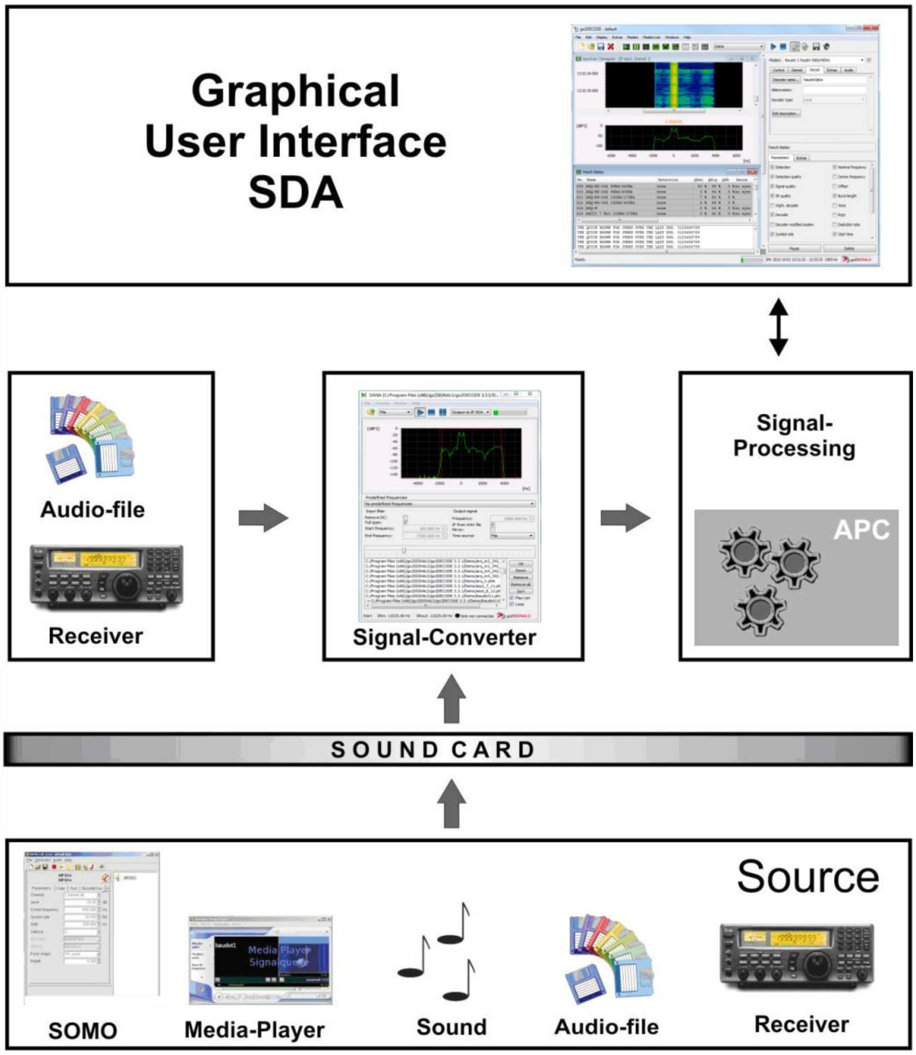


Figure 1 The Application at One Glance

DANA (cf. centre of the figure) is used as a signal converter and provides the module APC with the signal data in the required form of digital IF.

The module **APC** (central right section of the figure) handles the processing of signals, from the recognition of modems via the demodulation and decoding up to the permanent production of the message content. APC is a background process without user interface.

The module **SDA** (see top section of the figure) carries out the numerous tasks involved in display and user interaction. On the one hand, it provides graphic displays of the results supplied by the module APC; on the other hand, the user can edit parameters to control the operating mode of the APC.

SOMO (Subject to the delivered version)

The **SO**ftware **MO**dulator SOMO generates standard signals. SOMO can be used to teach the handling of the SDA operator interface. In combination with SDA, it is an appropriate training tool for inexperienced analysts. For more information on SOMO please refer to the SOMO Instruction Manual.

DANA

The converter module DANA (**D**igital **AN**alogue **A**udio Interface) receives the existing input data from sound card or file and converts it into complex signal packages that can be processed by the APC. DANA features a graphical user interface which provides the option to edit various parameters. Among these pa-

rameters is the frequency, which is used to add an offset to adapt the centre frequency of a signal delivered by an external receiver, or a signal file, to the reference frequency of a demodulator.

APC

The module APC (**A**utomatic **P**roduction **C**hannel) is the core of go2DECODE. This software module handles the complete signal processing operation in a technical sense. Its tasks are real-time identification, demodulation, and decoding of signals pre-processed by DANA. The results are sent to SDA for display.

The APC controls the following tasks:

- Energetic fine segmenting (signal detection and signal selection)
- Detection (modem identification)
- Demodulation and decoding (modem production)

Go2DECODE is a knowledge-based system, i.e. the software is capable of reliable recognition, demodulation and decoding of modems which have been included in the knowledge base of the system, using the experience of the analysts. The standard version features a selection of demodulators and decoders as well as selected modems combined from them. The user can edit the parameters of, or combine, additional modems from the existing demodulators and decoders. The decoder description language provides the option to develop new decoders, which again can be combined with existing demodulators.

SDA

The module SDA (**S**ignal **D**isplay & **A**nalysis) is the central graphical user interface. The main functions of SDA are:

- Display, listening and monitoring of the incoming signals
- Display of the transient signal memories to check the APC function
- Display of the results
- APC control and parameter editing
- Editing the parameters of the modems
- Editing the parameters of the displays in the active window
- Provision of analytic measuring tools
- Development-environment for the decoder description language

For further details on the various SDA functions and its operation, please consult the respective introductory chapters and the sections about SDA in this manual.

Sources

Signal data can be provided to go2DECODE from a great variety of different signal sources. In a rough abstraction, three categories of sources are distinguished:

- Signals via sound card
- Signals from files directly via DANA
- Signals via LAN (data streams from any type of receiver)(Subject to the delivered version)

On the following pages, we introduce you to these applications and provide an overview of all functions available. Generally, the programs can run on different computers and exchange data via TCP/IP. go2DECODE, however, is a standalone system whose modules are linked via loopback adapter with virtual interface.

go2DECODE

Application Monitoring

go2DECODE features two major configurations: go2DECODE and go2DECODE Monitoring, the differences are explained in this chapter.
go2DECODE is intended for use in the technical centre for online and offline analysis of signals, automatic recognition, demodulation and decoding. The Application allows for development of decoders by means of the decoder description language DDL, and for creation of new modems using the universal demodulators and the proprietary decoders. This way, the system's knowledge base will grow with the knowledge of the technical centre’s experts. Newly developed modems can be deployed to go2DECODE Monitoring for further use.
The go2DECODE Monitoring is used in the interception stations to automatically detect, recognize, demodulate and decode signals with the use of the knowledge base. Any modems developed by the technical centre can be easily imported into the Monitoring version to increase the knowledge base. It is further possible to record both unknown and recognized signals. These signals can be played back in go2DECODE version in the technical centre.

Comparison between go2DECODE Full Version and go2DECODE Monitoring

The following tables compare the features available in go2DECODE and Monitoring.

- Available
- **X** Not available

Modules available:

Module	APPLICATION	APPLICATION Monitoring
APC	●	●
SDA	●	X
SDA Monitoring	X	●
DANA	●	●
SOMO (Subject to the delivered version)	●	X
Decoder development environment consisting of decoder editor, decoder debugger and compiler	●	X

Table 1: Application Modules

Features available:

Feature	APPLICATION	APPLICATION Monitoring
Automatic Processing		
Max. signal bandwidth 50 kHz	●	●
Start / Stop	●	●
Processing of Modem Lists	●	●
Force Processing of Specific Modem	●	●
Recognition Strategy First	●	●
Recognition Strategy Best	●	●
Signal Displays		
Spectrum / Sonagram	●	●
Spectrum	●	X
Constellation Display	●	X

Feature	APPLICATION	APPLICATION Monitoring
Time Domain	●	X
Eye Pattern	●	X
Analysis Display	●	X
Hell Display	●	X
Bit Display	●	X
Manual Signal Analysis	●	X
Knowledge Base of Modems		
New Modem List	●	X
Load Modem List	●	●
New Modem	●	X
Load Modem	●	●
Change Modem Parameters	●	X
Result Handling		
Text Display	●	●
Display of Measured Parameters	●	●
Result File for Production	●	●
Wave Files for A3E/J3E	●	●
Signal Input		
TCP/IP	●	●
Wave files	●	●
Raw Files	●	X
Sound Card	●	●
Demodulators		
Analysis	●	X
Automatic Processing	●	●
Decoders		
Analysis	●	X
Automatic Processing	●	●
Decoder Development		
Editor	●	X
Debugger	●	X
Compiler	●	X
DDL	●	X
Recording		
IF to Raw Files	●	●
AF to Wave Files	●	●
Replay		
Raw Files	●	X
Wave Files	●	●

Table 2: Application Features

Installation of the Program

System Requirements

IBM-compatible PC or notebook with a minimum of

- one hard disk
- one CD-ROM drive and
- one free USB port (dongle version only)

There may be additional requirements depending on the selected receiver.

Component	Recommended	Minimum
Processor(s)	Intel Core i5 / i7 or equivalent AMD	Pentium 4 or Intel Core 2 Duo or equivalent AMD
Clock rate	>= 2.8 GHz	>= 1.8 GHz
OS	Windows 7	Windows XP
RAM	2 GBytes	1 GBytes
Hard disk space for programs	700 MBytes	50 MBytes
Hard disk space for IF storage	> 4 GBytes	4 GBytes
Sound device	Full-duplex 16-bit sound Card with sample rate >= 96 kHz with “Stereo Mixer” input	16-bit sound card with sample rate >= 44.1 kHz
Screen resolution	1600 x 1200 with 24 or 32 bits	1280 x 1024 with 16 bits

Table 3: System Requirements

Copy Protection

go2DECODE is secured by a copy protection. This protection is either linked directly to a specific computer, or it is based on a dongle. In the latter case, which is the standard, a license-file is required, which enables certain features depending on the functionality chosen for the system. Installation varies slightly depending on the version you install, and the Setup Assistant will guide you through the respective steps.

Dongle Version

In the dongle version of go2DECODE, the software will not run until a dongle (USB WIBU Key) is connected to the port and the respective hardware drivers have been installed. The dongle is supplied with the software.

go2DECODE

Figure 2 Dongle Version

Installation

Make sure the WIBU Key is not yet connected to the USB port of your computer.

Subsequently insert go2DECODE CD into the CD-ROM drive. Setup will start automatically; otherwise start the file *setup.exe* from the CD-ROM. Follow the instructions on the screen and in the present Instructions.

Figure 3 Welcome Message

Subsequently, you will see the welcome message of the Setup Assistant.

Strike <**Next**> to continue.

In the next step, please read the License Agreement and, should you have no objections, agree to these terms and conditions by clicking the respective radio button.

Figure 4 License Agreement

Installing the Dongle Version

On the dongle version you will see the following WinZip Self Extractor dialog.

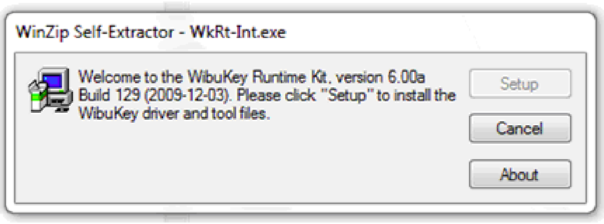


Figure 5 Welcome Message

The WIBU Key Software setup program will be launched automatically within a few moments, showing the following dialog box:

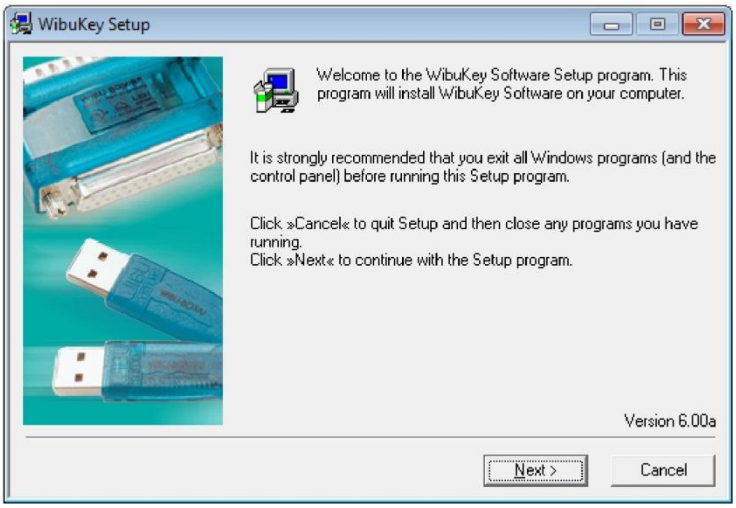


Figure 6 WibuKey Setup

Follow the instructions on screen and press <**Next**>.

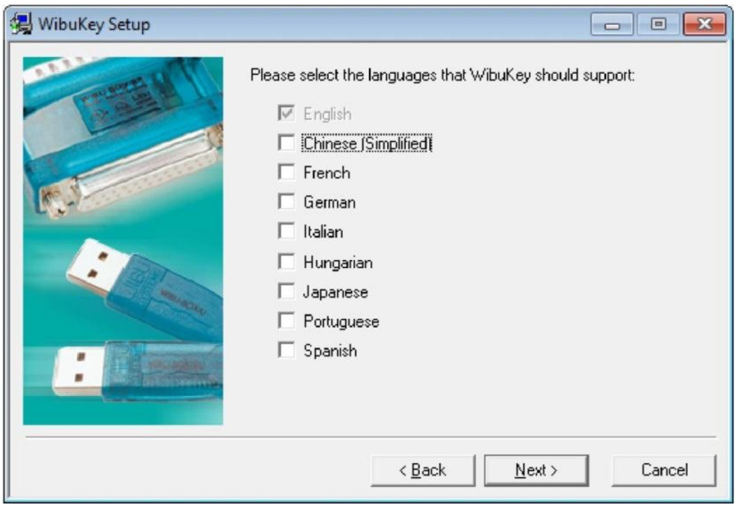


Figure 7 Select Language

Now select the language you wish to be supported. The language of your operating system will be detected and checked automatically. Activate the button <**Next**> to continue.

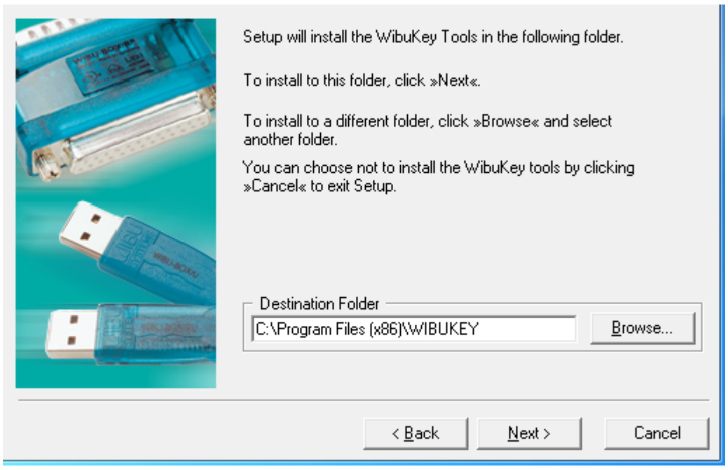


Figure 8 Select Destination Folder

Confirm with <Next>

In this dialog box, specify the target directory for the WIBU Key tools. In case the folder specified does not exist, the following message will be displayed:

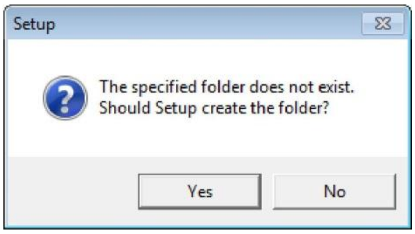


Figure 9 Create a New Folder

Click <**Yes**> to have Setup create this folder. On completion, the following dialog will be shown:

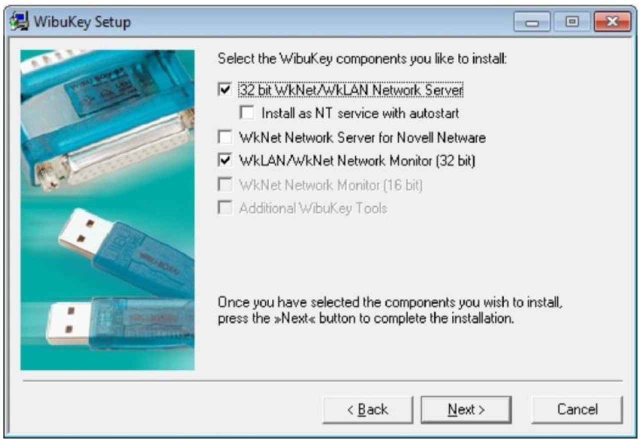


Figure 10 Select WibuKey Components

Now select the components you require and click <**Next**>.

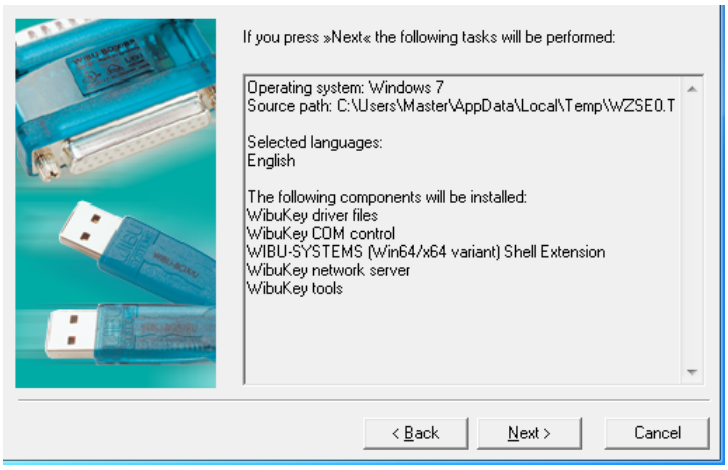


Figure 11 Tasks of WibuKey Installation

In the next dialog, verify your selections. To make a change, press the button <**Back**>, otherwise strike <**Next**> to continue. The installation starts, and its progress is shown in the dialog below:

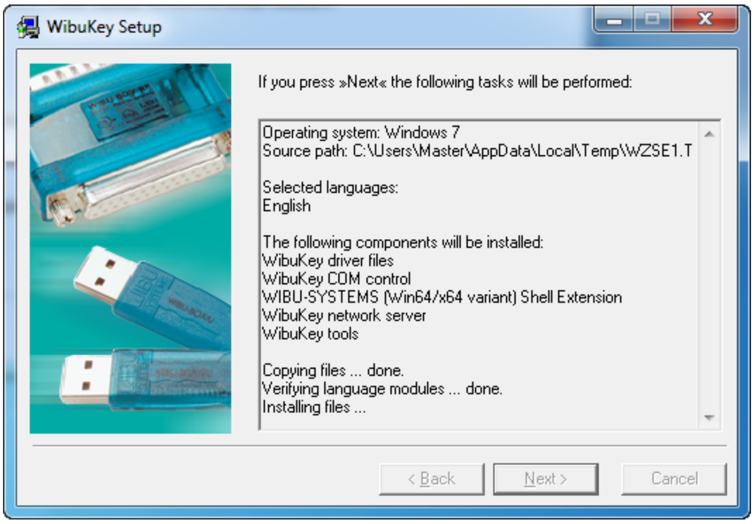


Figure 12 WibuKey Installation Progress

Once all items have been successfully processed (the button <**Next**> is active again), click <**Next**>. The WIBU Key Software setup is complete:

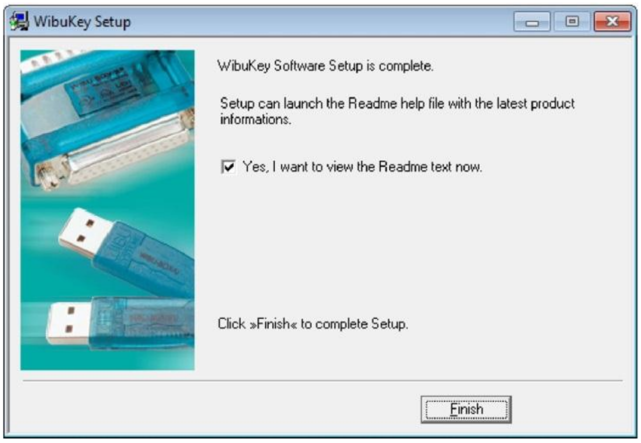


Figure 13 WibuKey Installation Completion

In this last dialog, specify whether or not you wish to read the help file now by means of the check box, and click <**Finish**>**.** Setup is finished:

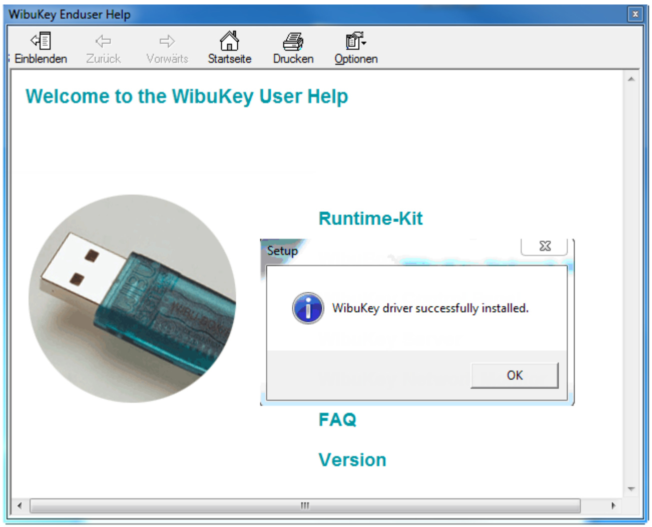


Figure 14 Help Manual with Installation Complete

Now select <**OK**> to close the setup.

On the next dialog box, specify the target directory in which to install go2DECODE and indicate whether to install the demo signals provided (recommended).

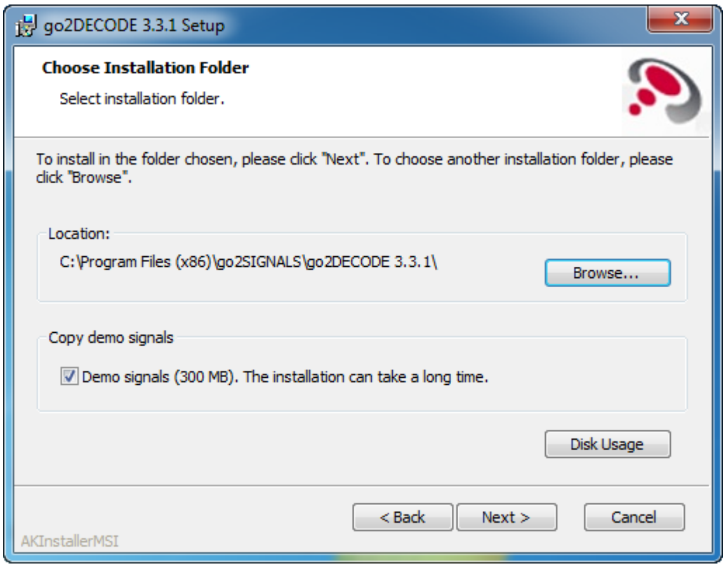


Figure 15 Choose the Location for the Installation

Strike <**Next**> to continue. The following dialog box is shown:

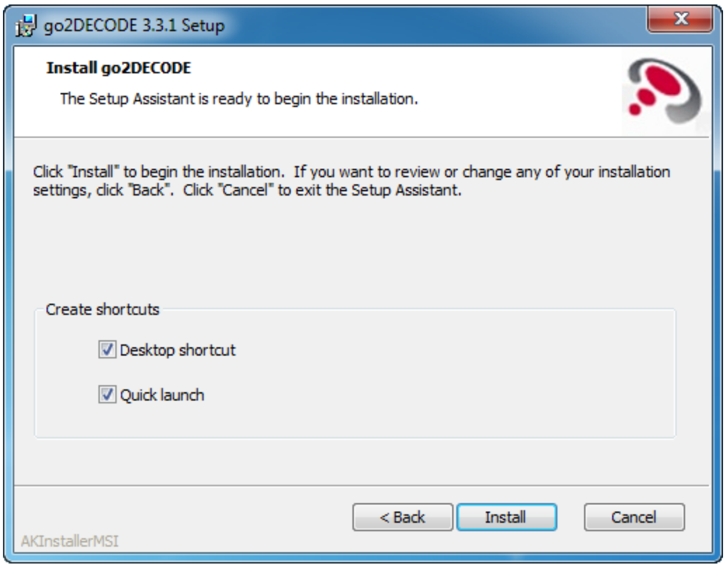


Figure 16 Setup Assistant Ready

The check boxes are set to their default values and can be deactivated if desired.

Now press <**Install**> to trigger the installation.

At this point, the Microsoft Visual C++ Redistributable will be installed if it is not already available on your PC.

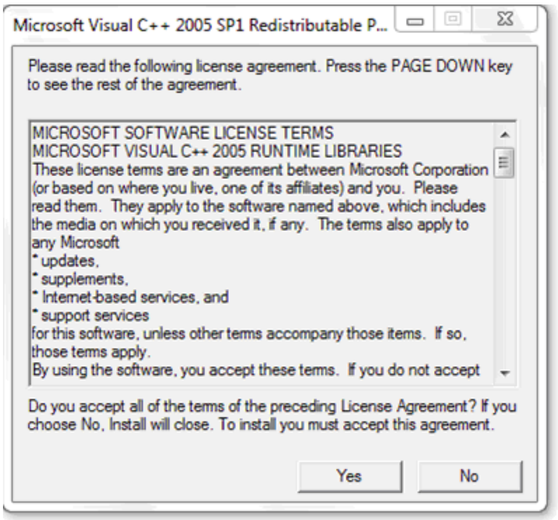


Figure 17 License Agreement

The license agreement is displayed, and must be acknowledged by striking the button <**Yes**>.

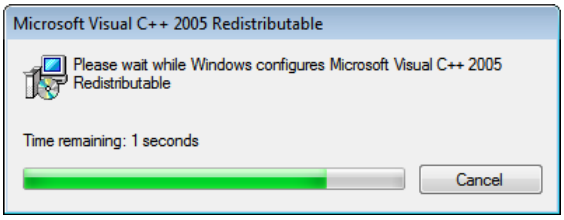


Figure 18 Configuration and Installation

The installation continues, showing the progress and asking you to be patient until the configuration are completed and the required information has been located:

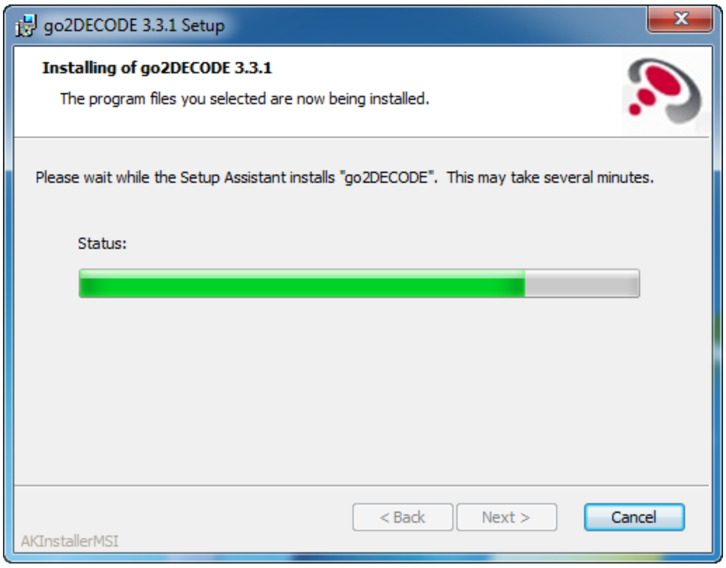


Figure 19 Application Installation

On successful installation, the Setup Assistant will display the following message:

Figure 20 Installation Completion

Select the respective check box to read the **Readme** file to this installation and to install Acrobat® Reader. Push <**Finish**> to exit the setup.

Connecting the Dongle

Subsequently, connect the USB dongle to a free USB port of your computer. In case the dongle had been connected before, please disconnect the dongle, make a restart, and reconnect the dongle to the port. Your installation is complete.

Starting the Software

Starts the main Application or the individual added applications either using the desktop icons or go2DECODE program group on the start menu:

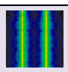
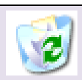
Icon	Name	Description
	Application	Start go2DECODE including SDA, DANA, etc.
	DEMO	Starts go2DECODE playing back demo signals. This feature is only available if the signal files have been installed.
	SOMO	Start SOMO (Software Modulation Signal Generator) (Subject to the delivered version)
	PMO	Start PMO (Production Memory Observer) for viewing results
	DANA	Start DANA (Digital ANalogue Audio interface) for signal input
	Decoder Debugger	Start Decoder Debugger only (Subject to the delivered version)
	Uninstall go2DECODE	Uninstall go2DECODE with all its components
	Apply for license	In the subfolder **target**, open the **Request_license.pdf** file explaining how to apply for an go2DECODE license.

Table 4: Desktop Icons

Uninstallation

Select **Uninstall** go2DECODE in the go2DECODE programs group in the start menu or, as an alternative, select the item **Programs and Features** on the **Control Panel**. Then click the item of go2DECODE and press the button <**Uninstall**>.

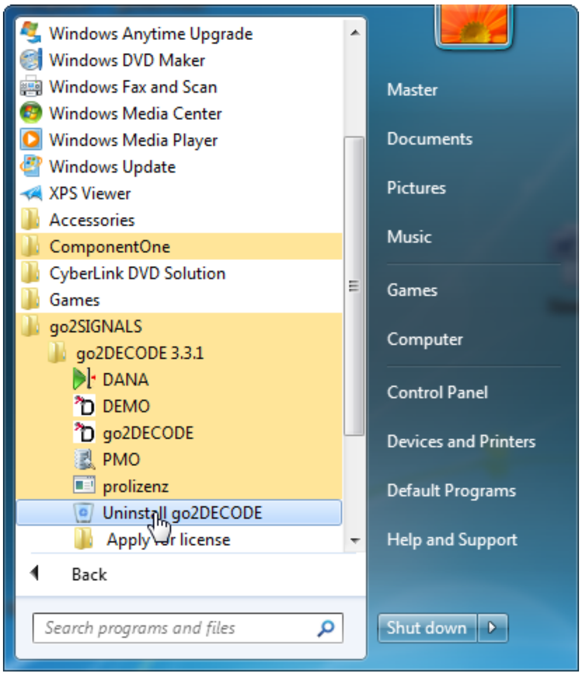


Figure 21 Start Uninstallation

The uninstallation process is initialized.

Acknowledge the uninstallation in the following alert message by striking <**Yes**>.

Figure 22 Uninstallation Confirmation

The Installer executes the uninstallation process while showing the status messages below.

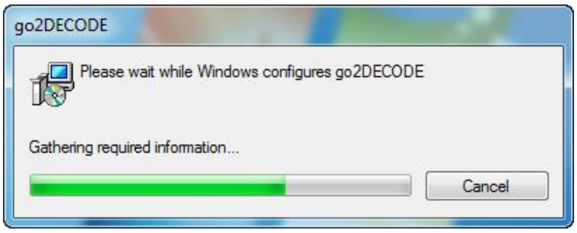


Figure 23 Status Message

This status message disappears once the software has been fully uninstalled.

Note that uninstalling the go2DECODE software will not uninstall the software for WIBU Key Runtime.

To do so, select the item **Programs and Features** on the **Control Panel** and repeat the above procedure for the items **Adobe...** and **WIBU Key...**.

Application Demonstration

For demonstration purposes go2DECODE DEMO can be started via the appropriate desktop icon or the start menu (depending on the installation).

Calling up go2DECODE DEMO will start three applications. Use the options specific to your operating system to switch from one application to the other:

DANA: Filtering and conversion of the input signal into digital IF

APC: Automatic recognition of modems whose parameters have been previously entered into the knowledge base

SDA: Result display for APC and user interface for monitoring and manual analysis of the digital IF

If you are using the go2DECODE Demonstration, the signal sources are files.

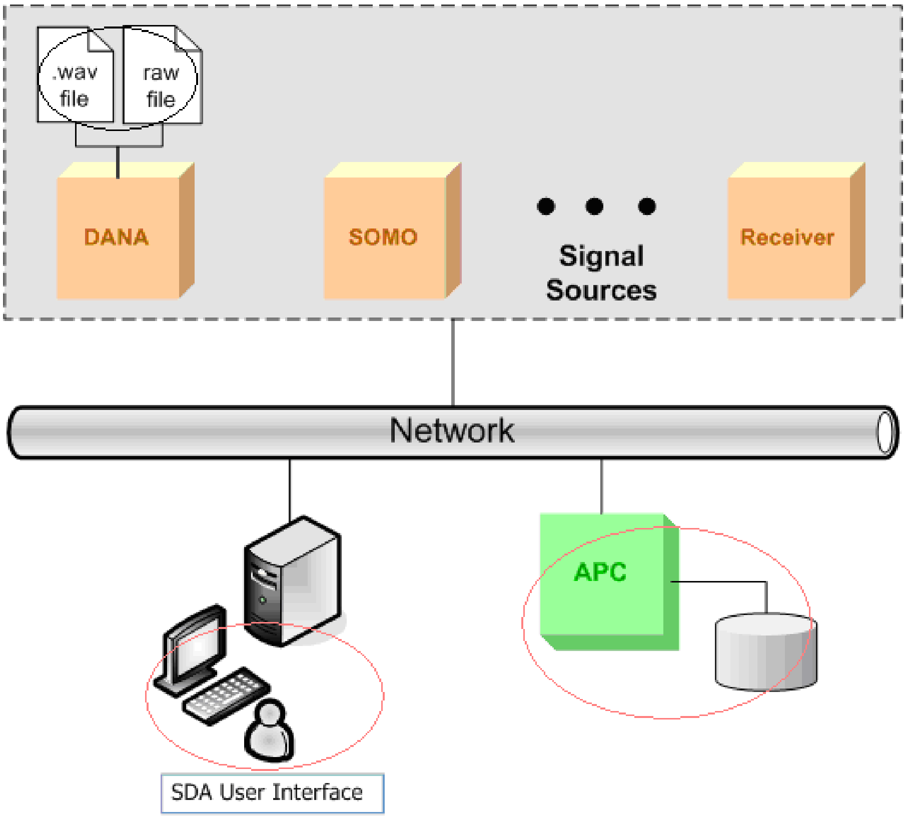


Figure 24 Signal Sources

Starting go2DECODE

Select the component in go2DECODE program group of the start menu or, as an alternative, select the item **Programs and Features** on the **Control Panel**. Then double-click the icon of the selected component.

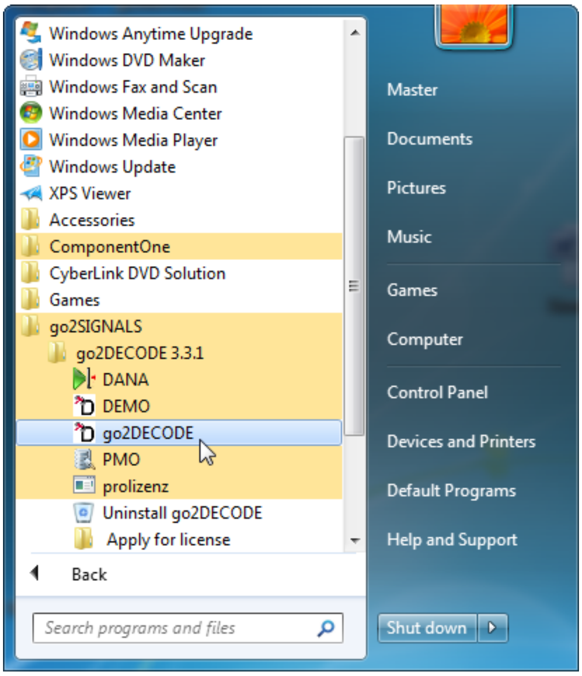
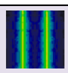


Figure 25 Start go2DECODE

Icon	Name	Description
	Application	Starts go2DECODE including SDA, DANA, etc.
	DEMO	Starts go2DECODE playing back demo signals. This feature is only available if the signal files have been installed.
	PMO	Start PMO (Production Memory Observer) for viewing results
	DANA	Start DANA (Digital ANalogue Audio interface) for signal input
	SOMO	Start SOMO (Software Modulation Signal Generator) (Subject to the delivered version)
	Decoder Debugger	Start Decoder Debugger only (Subject to the delivered version)

Icon	Name	Description
	Uninstall go2DECODE	Uninstall go2DECODE with all its components
	Apply for license	In the subfolder target, open the Request_license.pdf file explaining how to apply for an go2DECODE license.

Table 5: Desktop Icons

In addition and for a flexible start you can use Commands to start the SDA:

Command	Place holder	Function
-conf <Config-File>	<ConfigFile> = Path and Filename of the Configuration File	Start the SDA with a Configuration Example: sda.exe –conf C:\Temp\sda_Rx1.conf
-dirCompatibility	n/a	With this option (only Windows XP) you write the configuration file and the temp file in the Installation folder. This is possible only if you are logged in as administrator. The file for the Configuration changes must be the file directorySettings.conf. Example: sda.exe –dirCompatibility

Table 6: SDA Commands

After Start of go2DECODE

On program start of go2DECODE, the SDA will appear as in the screenshot below. You will see a spectrum/sonagram display, a result display, the menu bar, the toolbar, two property sheets, and the status bar. Together with the SDA go2DECODE DANA will start.

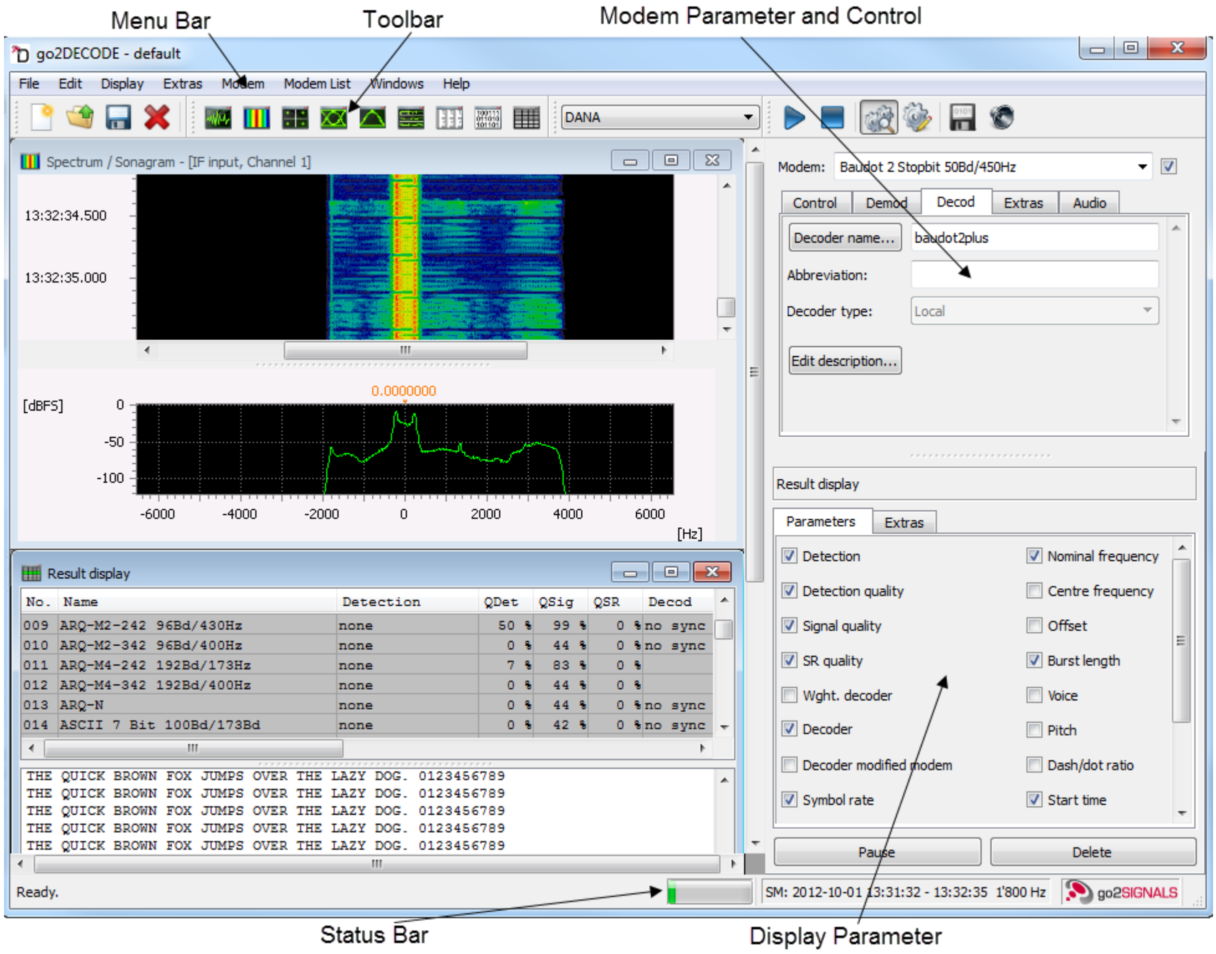


Figure 26 SDA User Interface with DANA

The left part of the window features two displays.

The spectrum/sonagram is a signal display showing the digital IF signal in two different presentations. The sonagram (top) shows the energy distribution of the signal in the frequency-time domain while the spectrum (bottom) indicates the spectral energy distribution of the most recent line at the bottom of the sonagram display.

The result display shows the modems currently stored in the knowledge base of the APC and the results of the automatic modem identification process.

The right-hand side of the window displays the following property sheets:

- In the upper part the parameters for APC control and parameter input for the APC modems are indicated. These parameter tabs include the demodulator parameters and the decoder selection.
- The lower part shows the parameters of the currently active display, such as general display parameters, cursor parameters and display parameters.

The status bar of the SDA is located at the bottom of the window. It indicates status messages and the time interval covered by the short-time memory (SM).

On starting SDA, you will see that the spectrum/sonagram displays the signal in single frequencies (the Figure shows a Morse signal). If, for example, a Morse signal from the demo files is applied, it can be detected near the frequency 0, and the typical pulses are visualized in the sonagram.

In the result display, you will first see the APC search. The color of the modem in the list varies depending on the state of recognition (e.g. the Morse line first turns yellow then orange when the demo file for Morse is played). This indicates that the Morse signal has been recognized by the APC. A moment later, the modem turns green and the decoded Morse text is displayed showing the final results.

In demo mode, this process repeats with each signal played.

SDA Operating Modes

SDA provides the option to supply signals from different sources. The following signal sources are available:

- DANA
- SOMO
- Signal Memory

These modes can either be set on the menu *Extras – Mode* or the toolbar.

Further signal sources can be added via the menu *Extras – Options.*

DANA

This is the default to analyze .*wav*-files or signals which are connected to the input of the soundcard. If you are using DANA as the signal source, the APC receives the signal data from DANA.

DANA features (default) a graphical user interface to analyze and edit various parameters.

SOMO (Subject to the delivered version)

By selecting the SOMO as the signal source it serves to generate standard signals to analyze and edit by the APC. The signal will be recorded in the signal memory of the APC.

Signal Memory

If signal memory is the signal source, you are able to analyze recorded signals The signal from the short-time memory of the APC can be analyzed.

Analysis offline serves to set the time at which the short-time memory is to start (start time) and stop (stop time) playback. Activate the button <**Star**t> to start over. To switch off the continuous play of the short-time memory, unselect the checkbox ☑ *Repeat replay* below the button <**End time**>.

Operation

In case you want to switch between signal-sources, please activate the symbol (Stop) in the tool-bar or press the <**Stop**> button in the property-dialog. Select the new signal-source and activate the symbol (Start) in the tool-bar or press the <**Start**> button in the property-dialog.

When the SDA is started and the button <**Automat**> has been activated, the system looks for the modem with the best recognition results of all. Once the modem is found, production will start at the time the search was originally started. Production will then be quicker than in real time until all former signal data has been processed by the APC. Subsequently, the data is sent to the SDA in real time again.

When the feature *Automat* is deactivated, the system is in manual production, i.e. the APC attempts to produce results with the modem currently selected. The current modem is displayed above the control and modem parameters. Additionally, it is displayed in bold letters in the result display.

The remaining control parameters apply to the automatic production of the APC. If a signal is applied and not recognized by the APC in automatic search mode, either modify the parameters of the existing modem or create a new one.

To edit the modem parameters, first select the modem to be edited. To do so, either use the modem list or double-click the respective modem in the result display.

Now select the tab <*Demod*> in the modem parameters form to display the demodulator parameters of go2DECODE by editing e.g. the symbol rate (velocity of the signal) or the shift (interval between lowest and highest frequency) of an FSK modem.

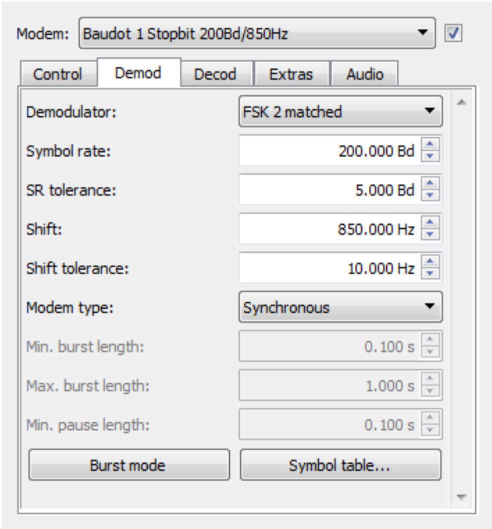


Figure 27 Modem Parameter Setting

To create a new modem, select the menu item *New modem* on the *Modem* menu. Now change the demodulator type and enter the respective parameters.

If the demodulated signal is to be decoded, select a decoder. Select the <*Decod*>tab and activate the button <**Decoder Name…**>. A list with the existing decoders will be displayed. Select the desired decoder and confirm by <**Ok**>. On completion of this selection, the selected decoder will be used for decoding.

If there is no appropriate decoder, either edit an existing decoder or create a new one (see Decoder Adaptation and Development).

Displays

The signal displays can be used to determine the demodulator parameters. Cursors are available to measure e.g. the shift or the symbol rate. The cursors are superimposed in the spectrum/sonagram display via the <*Cursors*> tab.

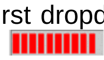
This way you can e.g. measure the shift by activating the “X Cursors“ in the spectrum/sonagram and placing the first cursor on the lower frequency and the second cursor on the upper frequency (Drag 'n' Drop).

Other displays for signal analysis are eye-pattern and analysis displays showing the IF signal as a time curve. The constellation display provides a display in the complex plane. The APC is capable of demodulating and decoding the signal. The output of a demodulator, the symbol stream, can be viewed by means of the Hell and bit displays. The Hell display is based on signals and the bit display is based on the symbols which are provided by the APC as a result of the demodulation procedure. The toolbar above the display windows serves to open the described displays.

Controlling the Signal Input using DANA

DANA stands for *Digital Analogue Audio Interface*. It serves to convert existing analogue signals from sound card or *.wav* files into complex IF signals and to provide these complex signals to the APC via TCP/IP.

Playback Mode Sound

If the input signal is applied via sound card (e.g. files created and played by the signal generator SOMO or *.wav* files played by Windows® Media Player), set the source to *Sound* in the first dropdown list box on the toolbar. Make sure the signal is not over modulated (red bars on the toolbar ). If so, readjust the Windows® volume control (cf. chapter Operation of DANA).

Playback Mode File

For direct playback of a *.wav* file, select the menu item *File* in the first dropdown list box on the toolbar. The signal cannot be played back unless the APC is ready (green dot on the status bar). To load the *.wav* file into the play list, either select the menu item *File – Open* or use the icon . Start playback by double clicking the file in question. For further information on the play list and its application as well as a detailed description of the entire program, please consult the chapter Operation of DANA.

Conversion

The input-signal can be shifted by an offset and it can be filtered.

To do so, select the setting *No Predefined Frequencies* and set the band pass limits in the spin boxes *Startfrequency* and *Endfrequency* as well as the centre frequency in the spin box *Frequency*.

To enable the APC to process the signal correctly, the frequency of this signal must "fit", i.e. the processing result mainly depends on the input in the spin box *Frequency*. The frequency of most of the signals will fit when the centre of the signal is in zero position.

Spectrum Display

The spectrum of the input signal and the output signal can be displayed each with adjusted filter range. The items to be displayed can be selected in the second dropdown list box on the toolbar (input: *Signal source*, output: *Output to IF SDA*).

SDA (Signal Display and Analysis)

Menu and Shortcuts

Figure 28 SDA Menu Bar

The following menus and menu items can be activated using the menu bar:

Menu	Function
File	Load and save settings, terminate SDA
Edit	Copy and paste text
Display	Start signal displays
Extras	Control functions of APC
Modem	Functions to maintain modems
Modem List	Functions to maintain modem lists
Windows	Functions to control the windows and the property sheets
Help	Documentation and information about SDA

Table 7: SDA Menu

File Menu

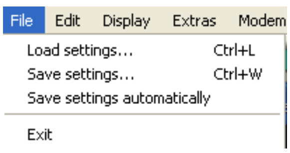


Figure 29 File Menu

This menu serves to load and save SDA settings. The following settings can be saved:

- Window position and window size of main window
- Show/hide property sheets
- Window positions and window sizes of the individual displays, if open
- All display parameters
- Window position and window size of the decoder editor as well as the last decoder edited, if open
- Status of menu item Save settings automatically

When the SDA is started, the file *default.cmf* will be loaded automatically. This file holds the default settings of SDA.

Menu Item	Function
Load settings…	Load previously saved settings
Save settings…	Save current settings
Save settings automatically	On selection of this option the standard settings will be overwritten with the current settings when exiting SDA
Exit	Exit SDA

Table 8: SDA Menu Items

Before loading the settings, switch to *Analysis* mode and switch off the *Automat*. The settings of the signal types and of the channel number of the displays are displayed as they were saved before.

Edit Menu

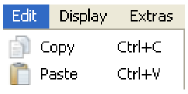


Figure 30 Edit Menu

Highlighted text blocks can be stored in the clipboard of your computer and pasted in other positions in the text using the functions *Copy* and *Paste*.

Please note that these functions can only be used in text windows, such as in the *Result Display* or in the *Decoder Editor*. They are disabled in other windows.

Display Menu

This menu enables to start the various signal displays available in SDA.

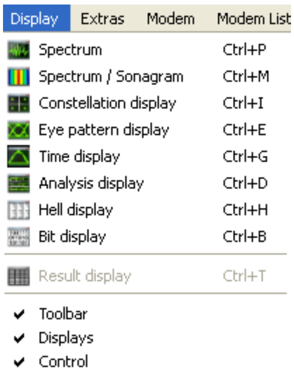


Figure 31 Display Menu

Extras Menu

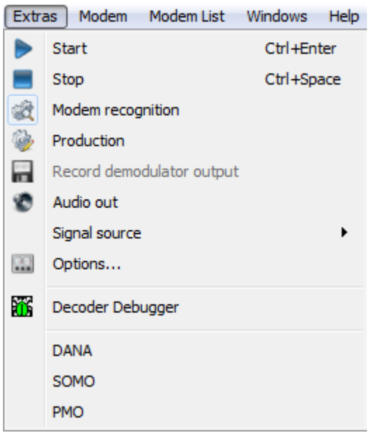


Figure 32 Extras Menu

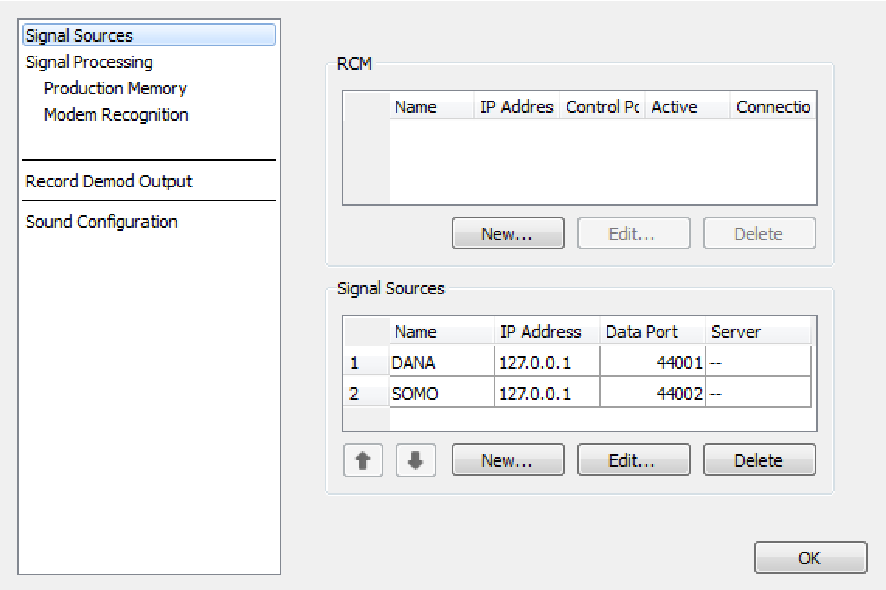
This menu provides various control functions and settings.

Menu Item	Function
Start	Starts the signal processing mode of APC. Additionally, SDA receives the signal data from APC.
Stop	Stops the signal processing and the incoming signals from the APC.
Modem recognition **Automat**	Starts and stops the automatic production mode of APC (toggle function). Start the signal processing mode of APC by means of Start to view the production output in the result display. Once the automatic production mode has been started, the control and modem parameters cannot be edited. When the Automat is switched on and Start is activated, the search of a modem from the modem lists is started, i.e. the system searches for a modem that matches the signal. If a modem is found, output is produced from this modem for as long as the signal does not change.
Production	If modem Recognition is set to off then manual production is active. The APC starts production with the selected modem..
Record demodulator output	Select this menu item to start recording the demodulator output. This item is not available unless the Automat is deactivated.
Audio out	This item provides a toggle to start and stop the Audio out function
Signal source	This item serves to select one of the three different SDA operating modes, i.e. DANA, SOMO and Signal Memory DANA This mode is the default to analyze *.wav*-files and signals which are connected to the soundcard. The receiving signal source for the APC is DANA. Automatically the signal will be buffered in the APC. All control parameters except ☑ playback and start time can be edited. the button <**Start**> is inactive. SOMO (Subject to the delivered version) On selection of SOMO as the signal source the signal production from the SOMO will be analyzed and processed by the APC. Automatically the signal will be buffered in the APC. All control parameters except ☑ playback and start time can be edited. the button <**Start**> is inactive. Signal Memory Use this mode if you want to playback, analyze and process recorded signals. All control parameters can be edited.
Options…	This menu item is only available if the signal processing is stopped. Via the dialog Options you can adjust the parameter of the Menus and Submenus showing on the left of the dialogs: Definition and adaption to the signal sources, alignment and adaption to the APC, limiting of recorded symbols,

Menu Item	Function
	selection and configuration of soundcards.

On the left side of the dialog a navigation-bar is displayed which provides 4 selections (Signal Sources, Signal Processing, Record Demod Output and Sound Configuration)

Dialog Sound Sources



In this dialog you configure and adapt to the signal server and signal sources.

The group field RCM shows a table of the connected signal servers. Signal servers in this case are applications which are used to provide separate signal sources (RCM provides the possibility to use multiple receiver as signal sources). all servers can be active or not active

Each signal server has a designation (chosen by the user), an IP-Address and a control port (to take commands through). Servers can be active or non-active. No connection will be established to inactive servers. The column connection shows the status on active servers.

no connection

connection is established

no connection (Server inactive)

A list of available Signal servers will be sent to the SDA after the connection to the signal server is established. In the group field “Signal Sources” a table of sources is shown. Editing of the table is not possible.

You can create new Signal servers by selecting the button <**new**>. A dialog with the input fields designation, IP-Address and control port (for details see ANNEX 1 Port Configuration) as well as a check box ☑ for activation will show up.

The designation of the server must be unique. You accept the modified values by selecting the button <**OK**>. With the button <**Abort**> you check out of the dialog with no changes.

By selecting the button <**Edit**> a dialog to modify the Server settings appears. This button is only active if you have selected a signal server. To display the configuration of a server you can start a viewer by selecting the button <**Show XML**>.

Server settings are cleared via the button <**Delete**>.This button is only active if you have selected a signal server. A security check will pop up and if you confirm, the settings of the selected server will be cleared.

Note: All related signal sources and the table content will be cleared, too.

The group field Signal Sources is used for the input and change of the signal sources. Signal sources (DANA, SOMO, Receivers etc.) produce Data signals which are processed by the signal processing components. There are user-defined signal sources and signal sources provided by signal servers. Signal sources from a signal server cannot be edited.

An overview is shown on the table. Each source has a unique designation, an IP-Address and

Menu Item	Function
	a control port and a server assignment. In the column Server you can see either “none” for user-defined sources or the name of the signal server. The display order in the table is equivalent to the display of the signal sources in the selected list of the SDA tool bar. To rearrange the order, use the arrows up ⬆ and down ⬇.

Using the button <**New**> you can create new (user-defined) definitions of signal sources. A dialog with input fields for designation, IP-Address and one data port appears. The IP-Address will define the PC on which the application providing the signal data is running. The data port defines the related port. You accept the modified values by selecting the button <**OK**>. With the button <**Abort**> you check out of the dialog with no changes.

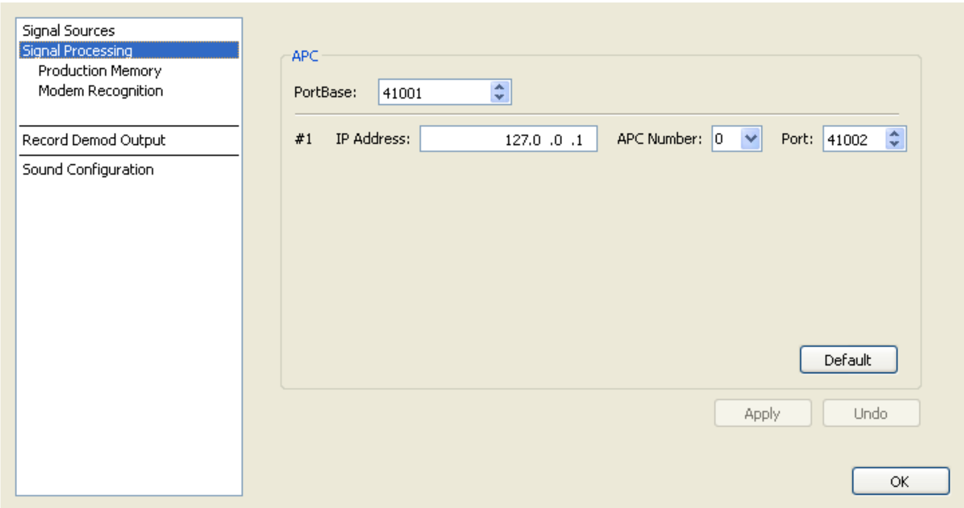
Using the button <**Edit**> the dialog for adaptation of the definitions appears. This dialog is only active if you have selected a user-defined signal source in the table. Accept for the predefined filled Input fields, the dialog is the same as in the dialog of the button <**New**>, but the fields are now filled with the values of the selected source.

Existent sources (user predefined) will be deleted via the button <**Delete**>. This dialog is only active if you have selected a user defined signal source in the table. A security check will pop up and if you acknowledge, the settings of the selected table and list of signal sources in the SDA tool bar will be cleared.

Dialog Signal Processing

This dialog defines the Automatic Production Control (APC).

At the moment you can define one component.



In the rotary field PortBase you can enter the (base) value of the calculation for the separate APC port number. This calculation is based on the formula:

Port= PortBase + (APC-number*100) + 1.

When changing this value, the field Port will be updated in respect to the formula,

except for the setting in the field APC. This will be ignored.

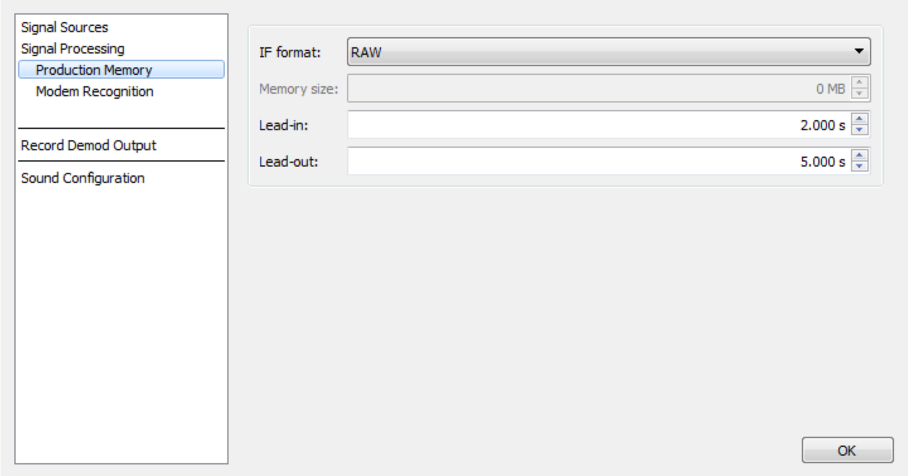
For identification of the component please insert an IP-Address, an APC number and a port (for details see ANNEX 1 Port Configuration).

Select the button <**Default**> to reset to the default settings.

On selecting the buttons <**Apply**> or <**Undo**> you apply or discard your settings.

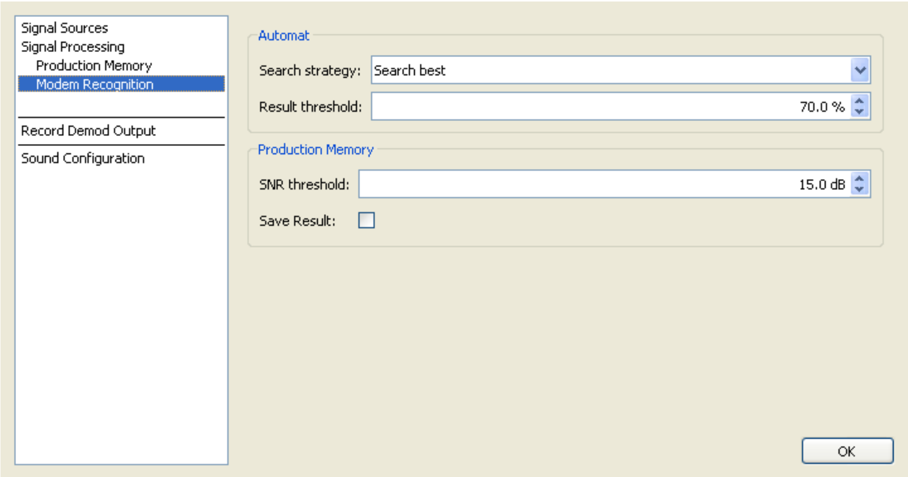
Dialog Production Memory

<table>
<tr><th>Menu Item</th><th>Function</th></tr>
<tr><td></td><td>



In case of a voice or morse modem the audio-content of the transmitted signal will be recorded and saved to your hard-disk if the option “Audio in file” is activated in the demodulator property page. The parameter Lead-in defines the start of the recording in advance of the actual production start time. In contrast, the parameter Lead-out defines how much longer the recording will last if the voice/morse detector has lost the signal and stopped production.

Dialog Modem Recognition



Search strategy
"Search first": The modem which first exceeds the result threshold will be processed by the APC.
“ Search best”: The modem with the best result of all modems above the result threshold will be processed by the APC.
Result threshold
Threshold for detecting modems. The delivered modems are optimized for a threshold of 70%. Changing these parameters is not recommended.
☑ Result
If the IF-storage is activated via the check box ☑ additional parameters are saved in an XML-file.
This file will be saved in the directory of the Production Memory.
You can view it with the help of the Production Memory Observer (PMO)
SNR Threshold

</td></tr>
</table>

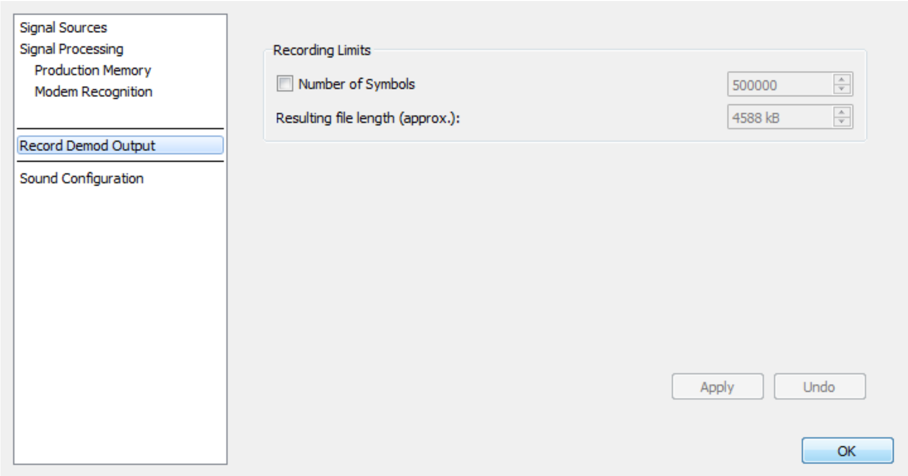
<table>
<tr><th>Menu Item</th><th>Function</th></tr>
<tr><td></td><td>

Adjustment of the signal to noise ratio (SNR) for the start of the recording. This signal will be considered if the recording is set to UK-signal or signal identified.

40% to 100%: The detection depends on the modem parameter. The higher the threshold, the better the match between modem and signal has to be.

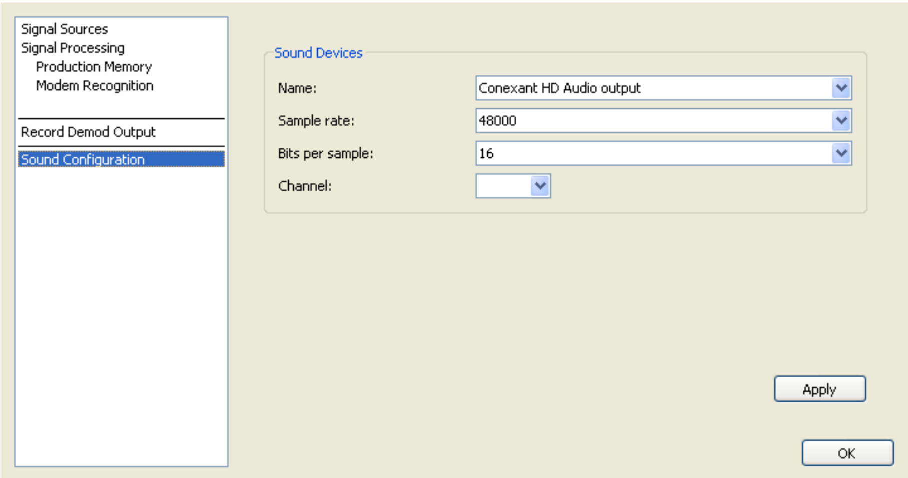
Dialog Record Demod Output:

The tab <*Record Demod Output*> serves to edit the maximum number of symbols for this function. The text box is enabled on pressing the button <**Number of Symbols**>. The box <Resulting file length approx.> indicates the conversion.



To do so you have to activate the check box ☑ Number of signals and set the rotation field “ resulting file length (approx.)” to the desired limit. The resulting file length will be displayed (in kb). On selecting the buttons <**Apply**> and <**Undo**> you apply and discard your settings.

Dialog Audio Configuration:



If your system features various sound cards (e.g. with different numbers of channels), use the tab <*Sound configuration*> to select and configure the existing sound output devices. When the dialog box is displayed, select the desired sound device, enter the values for sample rate and bits per sample, and edit the number of channels (for details see ANNEX 2 Sound Configuration)

</td></tr>
</table>

Menu Item	Function
Decoder Debugger	Open and Close the Decoder Debugger (Subject to the delivered version)
DANA	Start of DANA
SOMO	Start of SOMO (Subject to the delivered version)
PMO	Start of PMO (Subject to the delivered version)

Table 9: Extra menu items

Modem Menu

The modem description (hereinafter referred to as “modem“) provides the demodulator and decoder parameters of the modem. All demodulator and decoder parameters are saved in the modem file. The various rows in the modem list each represent one specific modem.

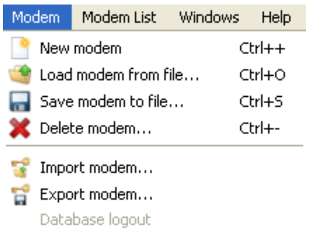


Figure 33 Modem Menu

Each modem can be saved either individually in one file or in combination as a modem list. The following functions serve to facilitate your work with modems:

Menu Item	Function
New modem	Add a new modem to the bottom of a modem list.
Load modem from file…	Load modems previously saved to a data medium. A dialog window is displayed for selection of one or several modem files (*.*ver*). The modems will be added to the bottom of the modem list.
Save modem to file…	Save the modem currently selected in the modem list to a data medium. A dialog window is displayed to enter a file name for the modem.
Delete modem	Delete the modem currently selected from the modem list.
Import modem…	Import modems with decoder files previously exported to a data medium. A dialog window is displayed for selection of one or several files (*.*vea*). The modems will be added to the bottom of the modem list, and the decoder files will be copied to the folder **code**, respectively.
Export modem…	Export the modem currently selected in the modem list to a data medium. The respective decoder files (*.*txt*, *.*bin*) for this modem will be exported as well.

Table 10: Modem Menu Items

Modem List Menu

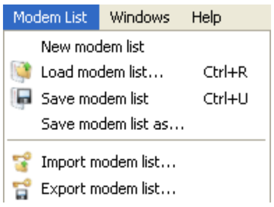


Figure 34 Modem List Menu

The modem list includes all modems currently available as well as various additional parameters. In detail, these are:

- Search strategy
- Signal position
- Result threshold
- IF Saving mode
- Recording SNR

The following functions are available to facilitate your work with modem lists.

Menu Item	Function
New modem list	Create a new list with one modem as an example.
Load modem list…	Load one of the modem lists previously saved to a data medium. A dialog window is displayed for selection of a modem list. Once the loading process has been completed, the former modem list will be replaced by the new one.
Save modem list	Save the current modem list to a data medium.
Save modem list as…	Save the current modem list to a data medium. A dialog window is displayed where the file name for the modem list can be entered.
Import modem list…	Import a modem list as well as decoder files previously exported to a data medium. A dialog window is displayed for selection of the modem list (*.*cma*). The modem list is loaded, and the decoder files are copied to the folder code, respectively.
Export modem list…	Export the modem list to a data medium. The respective decoder files (*.*txt*, *.*bin*) for all modems included in the modem list are exported as well.

Table 11: Modem List Menu Items

Window Menu

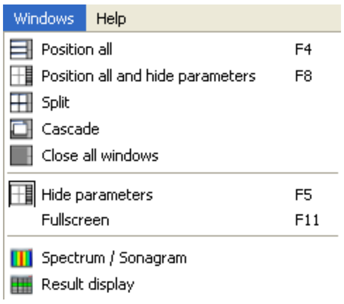


Figure 35 Window Menu

This menu serves to arrange the displays of SDA more clearly and shows a list of all SDA windows currently open.

Menu Item	Function
Position all	Arrange all signal and result display windows one below the other. Every window is displayed in the same size.
Position all and hide/show parameters	Arrange all signal/result display windows one below the other in equal size, and show or hide all property sheets (whichever applicable).
Split	Arrange SDA windows both next to each other and below each other.
Cascade	Arrange the windows of the signal displays on top of each other.
Close all windows	Close all open SDA windows.
Hide/show parameters	The property sheet currently displayed is hidden and, vice versa, hidden property sheets are displayed.
Hide Parameters	List of all open SDA windows. On selection of a window title in the menu, the respective window is activated and displayed in the foreground.
Fullscreen	Switching the display to fullscreen modus (toggle function).

Menu Item	Function
Spectrum/Sonagram	Switch to Spectrum or Sonagram mode.
Result display	Switch to result display.

Table 12: Window Menu Items

HINT: Use <**Ctrl**>+<**Tab**> to switch between display windows. Minimized windows will be restored if activated via the menu.

Help Menu

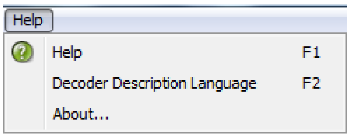


Figure 36 Help Menu

This menu provides detailed information about various subjects.

Menu Item	Function
Application help	Activate this item to display the present Operating Manual.
Decoder description language	Displays the operating manual for the decoder description language.
About…	Displays a splash screen showing the version and copyright information.

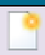
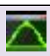
Table 13: Help Menu Items

Toolbar

The toolbar displays the major functions of the menu bar as icons. To activate the desired function, left click the respective icon.

Figure 37 SDA Toolbar

The functions are listed in the order as they appear on the toolbar:

Icon	Function
	New modem
	Load modem from file
	Save modem to file
	Delete modem
	Open spectrum
	Open spectrum/sonagram
	Open constellation display
	Open eye pattern display
	Open eye time pattern display

Icon	Function
	Open analysis display
	Open Hell display
	Open bit display
	Open result display
	Dropdown list box featuring the menu items D
	Stop the signal processing of the APC. SDA will not receive any further signal data
	Start the signal processing of the APC. SDA will now receive signal data.
	Automat on/off
	Production
	Record demodulator output
	Audio out on/off

Table 14: SDA Toolbar Icons

Shortcuts

The following shortcuts are available for quick activation of frequently used functions:

Function	Shortcut
Load settings	Ctrl + L
Save settings	Ctrl + W
Copy	Ctrl + C
Paste	Ctrl + V
Spectrum	Ctrl + P
Spectrum / sonagram	Ctrl + M
Constellation display	Ctrl + I
Eye pattern display	Ctrl + E
Analysis display	Ctrl + D
Hell display	Ctrl + H
Bit display	Ctrl + B
Stop	Ctrl + Space Bar
Start	Ctrl + Return
Automat	F10
New modem	Ctrl + +
Load modem from file	Ctrl + O
Save modem to file	Ctrl + S
Delete modem	Ctrl + -
Load modem list	Ctrl + R
Save modem list	Ctrl + U
Position all	F4

Function	Shortcut
Position all and show/hide parameters	F8
Hide/show parameters	F5
Instruction manual	F1
Decoder description language	F2

Table 15: SDA Shortcuts

Navigation in SDA Main Window

To navigate in the main window of SDA and to activate the functions, use one of the following three methods (depending on the current function):

- Keyboard shortcuts
- Left mouse button
- Popup menu via the right mouse button

You will find an overview of this subject in the previous chapter. Use the keyboard to enter, edit or delete text.

SDA User Interface

When starting the program, the SDA user interface is structured as follows:

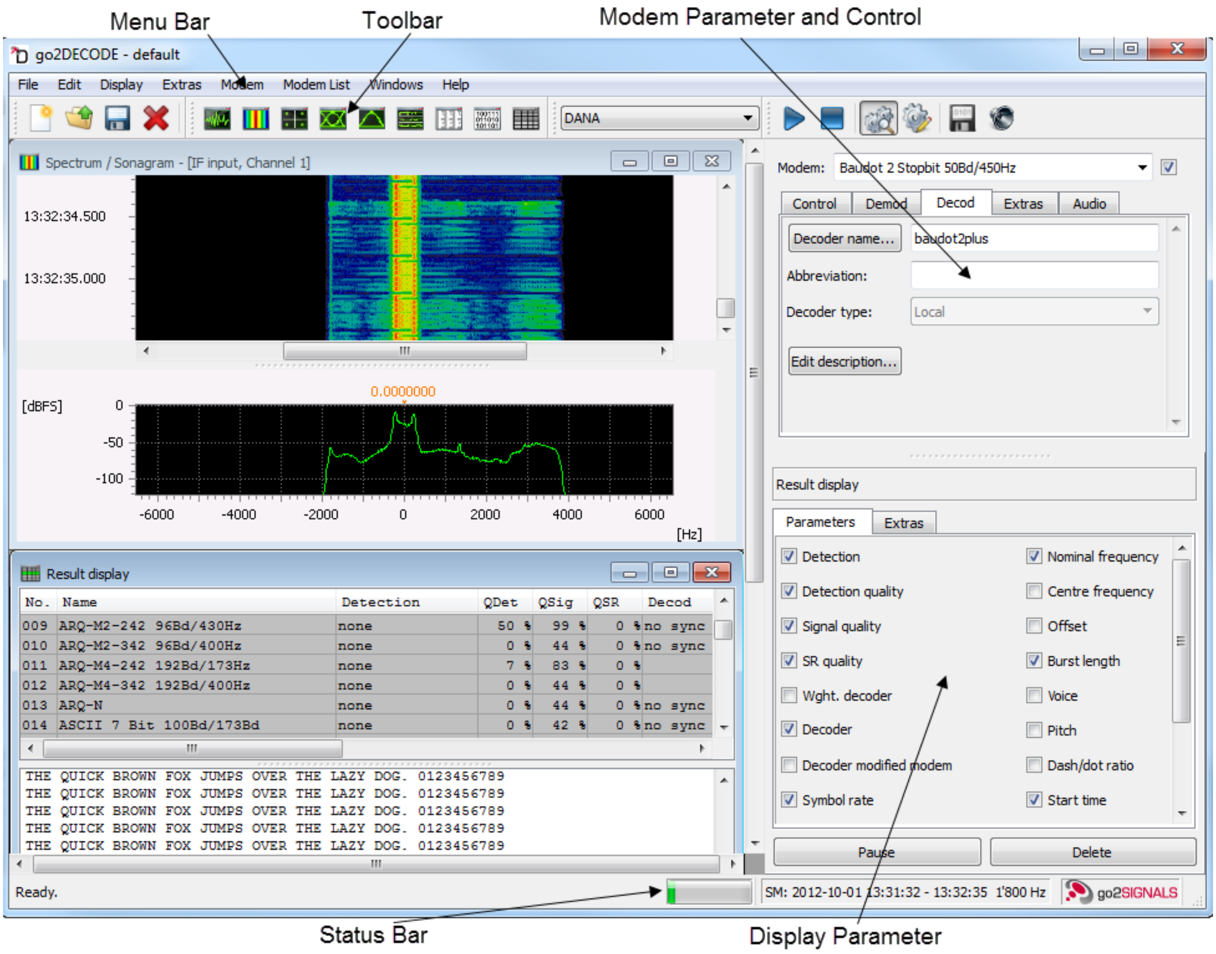


Figure 38 Typical SDA Interface

The SDA interface consists of four sections.

The left section contains all display windows currently open.

The right section features property sheets to view and edit the various parameters. Each sheet consists of several tabs.

- On the upper right is a sheet which serves to control the APC and to edit the parameters of the modems (demodulator selection and parameters, decoder selection, extras for modem parameter editing, and audio out, i.e. demodulator parameters and gain control). The modem currently active is displayed in a drop-down list box above these tabs.
- The display parameters on the lower right will vary with the active display window. To activate a display window on the left, left click the desired window and its parameters will be displayed on the lower right.
- Modems and displays are described in detail in the subsequent chapters.

There is a menu bar below the title bar of the program window, below the menu bar is a toolbar featuring frequently used items from the menu bar. In general, these are icons to start the displays and icons for control of the APC.

At the bottom of the user interface is a status bar. The left part of the status bar shows alert messages, errors or messages about the connection status to the APC. The right part features a load display as well as a display of the time interval at which the short-time memory of the APC stored the current signal. On selection of the item *Sonagram Display*, the load display shows whether time errors have occurred in the signal (red), or whether the display can no longer process all data in time (yellow). In general, both situations will not occur unless the system is under extreme load.

APC (Automatic Production Channel)

The task of the APC is the fully automated signal processing. This is achieved by detecting the signal and identifying the modem. The signal is then demodulated and decoded. Each of these steps can be controlled and modified by using the *Automat* control and the modem parameters (demodulator selection and parameter setting, decoder selection, extras for modem parameter setting, and demodulator parameters and gain control for audio out). The results are controlled and displayed in the result display.

Result Display

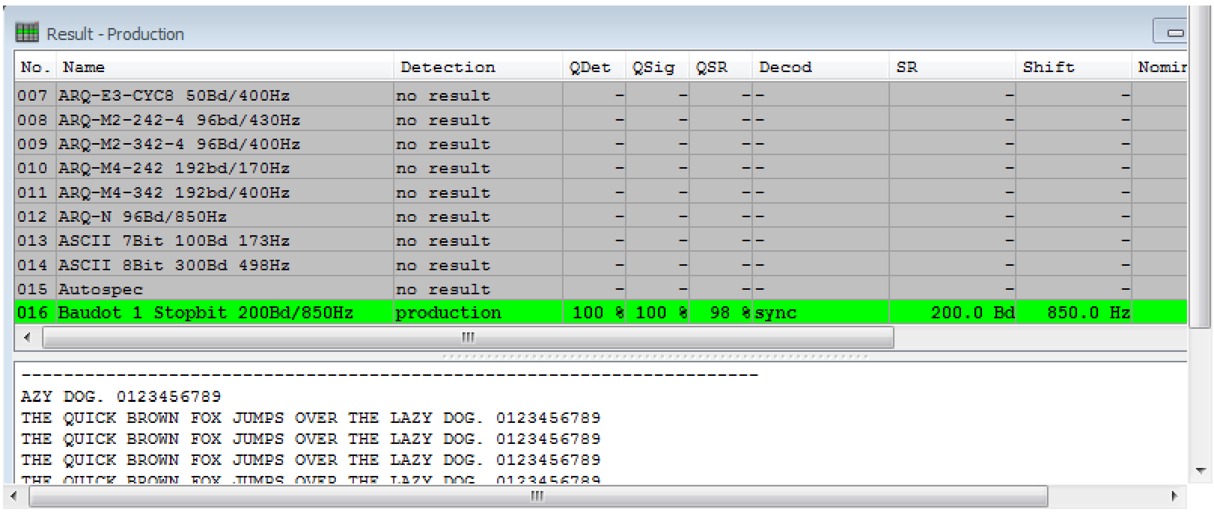


Figure 39 APC Result Display

The result display shows the search results and the production results of the APC. The upper part of the display shows a table including all modems executed by the APC, and the currently active modem (**bold**). The lower pane shows the final search and production results (APC messages, decoded text, runtime errors of the decoder) of the APC.

Depending on the status, you will see the following APC messages in the lower pane during production (apart from those that are self-explanatory such as "search start" or "production start", etc.):

Message	Description
uk signal detected	Unknown signal detected – edit parameters
uk signal detected, nearest [modem name]	Unknown signal detected with indication of closest possible modem – you may want to edit the parameters
uk signal detected, modulation similar [modem name]	Unknown signal detected with modulation similar to modem indicated – you may want to edit the parameters
modulation detected [modem name]	Modulation detected with indication of modem
modem detected [modem name]	The modem has been detected and production has started.

Table 16: SDA Messages

The result display can output decoder text with various text codecs. If the decoder has specified an unknown or invalid text codec, the software displays an error message.

Parameter Setting

To view the parameters of the result display, select the <*Parameters*> tab. All results except *No.* and *Name* are displayed by activating the various checkboxes.

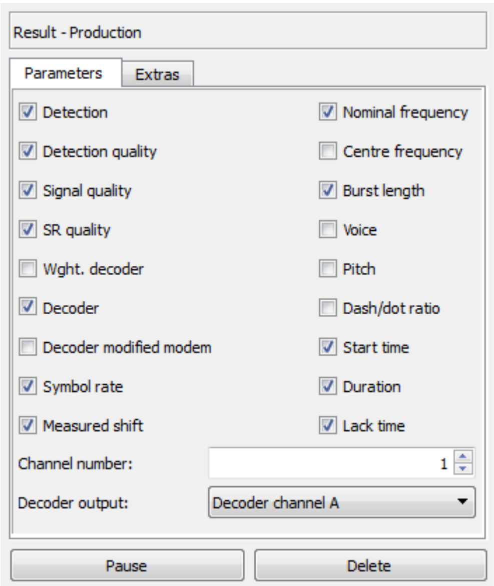


Figure 40 SDA Selection of Result Production

The table below lists the results in the upper part of the display together with their tasks:

Result Column	Function
No.	Number of modem (not selectable)
Name	Name of modem (not selectable)
Detection	Detection status of modem: No result: No statement on modem status possible Inactive: Modem has not been activated Impossible: Modem has been excluded during search due to its bandwidth None: Modem has not been detected No decoder: Only the modulation parameters of a modem have been detected Modulation: Modem has been detected on the basis of the modulation parameters Modem: Modem has been detected

Result Column	Function
	Lost: Modem was detected but is lost Production: Modem is produced Modulation tracking: The modulation type has been detected, tracking parameters Modem tracking: The modem has been detected, tracking parameters
Detection Quality	Detection quality of modem
Quality Signal	Quality of signal
SR Quality	Quality of reproduced symbol rate of a modem
Wght. Decoder	Weighting of decoder
Decoder	Status of decoder: No sync: Decoder not detected Identified: Decoder has detected modem characteristics in the data stream Accepted: Decoder has been detected Sync: Modem has been detected Error: Decoder runtime error
DMM (Decoder Modifies Modem)	This column indicates whether the modem has been modified by the decoder or not.
Symbol Rate	Measured symbol rate (speed at which the signal is transmitted) or keying rate (number of characters per minute) with Morse modems
Measured Shift	Measured shift (interval between the lowest and the highest frequency (Hz) in an FSK modem)
Nominal Offset	Interval to the nominal frequency (as opposed to centre frequency)
Centre Offset	Offset (interval to centre frequency) of the signal
Burst Length	Length of burst. Burst signals only exist for a period defined based on the burst length.
Voice	Transmission mode in a speech modem: USB (One Side Band: Upper side band) LSB (One Side Band: Lower side band) DSB (Double Side Band, Amplitude modulation) FM (Frequency modulation)
Pitch	Lowest frequency of speech signal
Dash/Dot Ratio	Scanning rate (dash-to-dot rate) in a Morse modem
Start Time	Time at which the modem was detected
Duration	Period during which the signal was detected
Lack Time	Time in which the signal was not detected

Table 17: SDA Parameter Settings

The following options are available:

Parameter	Function
Channel Number	This option serves to display the text of other decoder channels (if any)
Decoder Output	Toggle between Decoder Channel A and B (default is Channel A). This option is only effective if the demodulator used provides F7B mode, e.g. F6/F7B.
<Pause>	The display is halted in Pause. Now edit the parameters for more detailed examination of the results.
<Delete>	Deletes the buffer and the display of the final results

Table 18: SDA Parameter Options

To edit the display parameters of the final results in the lower part of the display, select the tab *<Extras>.* The following parameters are available:

go2DECODE

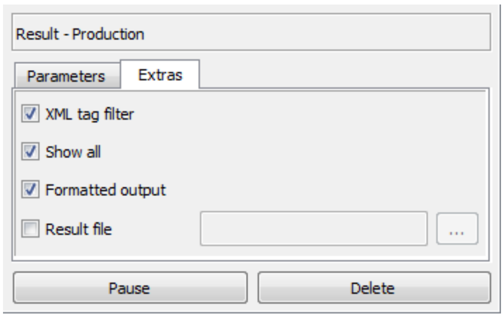


Figure 41 SDA Dialog Extras

Parameter	Function
☑ **XML Tag Filter**	The plain XML result is displayed if this checkbox is selected.
☑ **Show all**	In case of an unsuccessful search of the **Automat**, tick this checkbox to view additional messages in the lower result pane, such as the modem closest possible to the signal.
☑ **Formatted output**	Unselecting this checkbox will deactivate the formatted output. A considerable amount of additional information about the final results is displayed.
☑ **Result file**	By activating this checkbox, the raw results of the output will be saved in a file. If no file has been specified, a file dialog will be displayed to select a base directory in which to save the results. A “results” directory is created in the base directory. The file “results.css” (required to view the result file with a web browser) is copied to this directory.

Table 19: SDA Extras Parameters

A popup menu is opened by activating the right mouse button in the table with the temporary results. Various functions can be applied to the modem displayed in this table:

Use modem	The active modem (bold) is replaced by the selected modem
Save modem	Save the modem previously selected from the modem list to a data medium. Open a dialog window for input of a file name for this modem.
Delete modem	The selected modem is deleted from the list of modems.

Table 20: SDA Modem Parameters

You may also use (activate) modems by double clicking the respective modem row in the table.

Another popup menu will open by activating the right mouse button in the result text window:

Copy: Copy highlighted result text to clipboard

Select All: Select complete result text

The contents of the result windows can be highlighted using the mouse.

APC Control Parameters

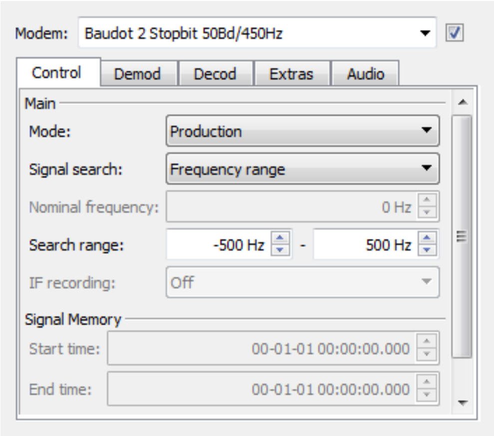


Figure 42 SDA Control Parameter

Tab	Task
Control	Modify the parameters controlling the automatic production. This will affect the entire modem list.
Demod	Select demodulator and edit the parameters of the APC's demodulation process in the active modem
Decod	Decoder selection by the active modem
Extras	Edit additional parameters in the active modem
Audio	Parameters of the demodulator and gain control used by Audio Output

Table 21: SDA Tabs

The functions of these tabs are explained below.

Modem List

Apart from the result display, the modem list is the other way to display all modems. It includes all modems that can be used in automatic production to identify the modem of a new signal. To call the modem list, activate the box *Modem* in the dropdown list.

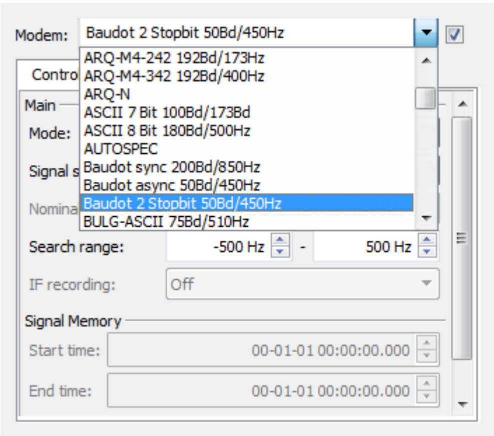


Figure 43 Dropdown List Box Modem with Modem List

Once the dropdown list is activated, a text cursor will appear so that the name of the active modem can be edited. On pressing the down control on the right, the dropdown list will open showing the list of modems. If the list includes a great number of modems, a scrollbar will appear on the right. Grab the slider of this scrollbar with your mouse cursor and slide downward to see the remaining part of the modem list. Click the desired modem to activate it. Use the cursor keys “Up“ (↑) and “Down“ (↓) to quickly move between modems.

Deactivating the checkbox to the right of the dropdown list box will deselect the modem from the APC modem list. Use this feature to exclude modems from the modem list in automatic production.

Control

The control parameters serve to set the following areas of the APC.

- Automatic identification
- Duration of the production process
- Supervising of the production process
- Saving of signals

The parameter settings will take effect not only on all modems but also on all signal displays. Activate the <*Control*> tab to edit the parameters:

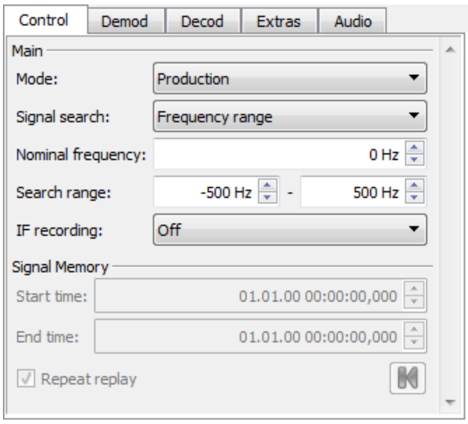


Figure 44 APC Control Parameters

Parameter	Function
Mode	Selection of the operating mode of the Automat
Signal search	Frequency Range: The APC searches for signals in the defined search range. Nominal Frequency: Manual definition of the frequency offset of the signal. This is controlled together with the modem-specific parameter Offset Nominal Freq. on the <*Ex-tras*> tab.
Nominal frequency	Control of the frequency in which to search the modem
Search range	Modem types will be searched in the defined search range if Frequency Range is used
IF Recording	You can have the signals recorded by the APC. The recording can be made at different times. Off: Signal is not recorded. Detected modem: Recording is started on successful search. UK signal: Recording is started when no matching modem has been found, and when a signal has been identified, and when this signal has at least the signal-noise ratio defined in Record SNR. Signal detected: Recording is started as soon as the signal has been identified, and when the signal has at least the signal-to-noise ratio defined in Record SNR. Please note that the recording also depends on the start and end times. On: The complete signal is recorded.
Start time	Time at which automatic production is started. In mode Analysis Offline, this is also the time from which the recorded signal is read from the short-time memory.
End time	Time at which automatic production is stopped. In mode Analysis Offline, this is also the time from which the recorded signal is read from the short-time memory.
☑ Repeat replay	In mode Analysis Offline, you can have the recorded signal played repeatedly. To do so, select this checkbox.

Table 22: APC Control Parameters

When the SDA has been started using modem recognition, a search for the modem with the best result of all modems is carried out. Once the modem has been found, production starts from the time at which the search was started. This process will be faster than real time until the APC has processed all existing signal data. Afterwards, the SDA will again receive the data in real time.

In addition to the direct input, the time parameters and the numerical values can be edited using the cursor keys “Up“ (↑) or "Down" (↓) (corresponding to the up/down controls on the right of the spin box). This will change the digit on which the cursor is positioned. Position the cursor by means of the cursor keys “Right” (→) or “Left” (←).

The start and end times can be set both manually and by using the sonagram. First, activate the Z-cursors in the sonagram. Open the popup menu (right mouse click) in the sonagram (in mode *Analysis Offline)*, and use this menu to adopt the time position settings of the cursors as *Automat* parameters for the start time and the end time of the short-time memory. On selecting *start time* or *end time*, only the start time or the end time will be set; otherwise, the entire time range will be set

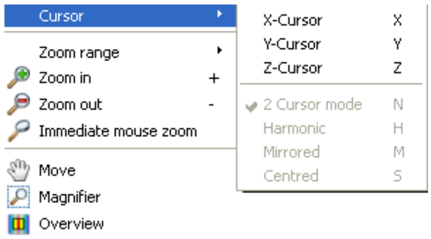


Figure 45 Sonagram Popup Menu

Demodulator Selection

The setting of the modem parameters directly affects the signal processing process, this way the characteristics of the modem can be modified. Transmission of a signal using high frequencies requires influencing (“modulating”) the signal to encode the transferred information in the signal. The basic high frequency (HF) signal is also called carrier. The APC has to reverse (demodulate) this influence to recover the information. The results of the demodulating process are symbols (one or several bits). Adjust the demodulation using the demodulation parameters. To do so, open the tab <*Demod*>.

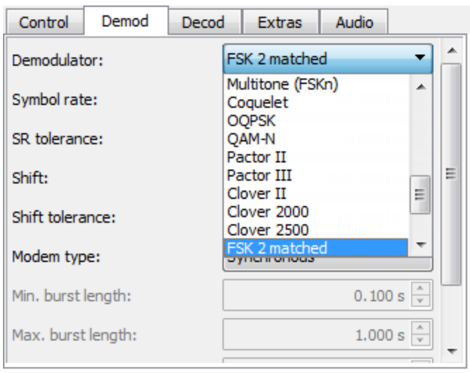


Figure 46 Tab Demod with Demodulator Drop-Down List

The *Demodulator* dropdown list box provides an extensive range of demodulator types. Select the demodulator type desired:

Demodulator Type	Demodulation of…
Voice	Speech signal
Morse	Morse signal
ASK 2	Amplitude shift keyed signal
FSK 2, 3, 4 discr.	Frequency shift keyed signal

Demodulator Type	Demodulation of…
FSK 2 matched	Frequency shift keyed signal
(G)MSK	(Gauss windowed) minimum shift keyed signal
DPSK 2, 4, 8 A/B	Differentially phase shift keyed signal
PSK 2, 4, 8 A/B	Absolutely phase shift keyed signal
Multitone (FSKn)	Multi-tone frequency shift keyed signal
MFSK 2	Multi-channel frequency shift keyed signal
MDPSK2, 4 A/B	Multi-channel differentially phase shift keyed signal
MPSK2, 4, 8 A/B	Multi-channel absolutely phase shift keyed signal
LINK-11	Bursted multi-tone and differentially phase shift keyed signal
ASK2PSK8	Quadrature amplitude modulated signal
ASK4PSK8	Quadrature amplitude modulated signal
QAM 16	Quadrature amplitude modulated signal
TFM3	Minimum frequency shift keyed signal
Clover II	Clover II signal
Clover 2000	Clover 2000 signal
Clover 2500	Clover 2500 signal
Pactor II	Pactor II signal
Pactor III	Pactor III signal
OFDM	Orthogonal frequency division multiplexed signal
F6/F7B	Four-channel frequency shift keyed signal and Morse signal
FSK 2,3 autoshift	Frequency shift keyed signal, automatic measurement of shift
OQPSK	Offset quadrature phase shift keyed signal
Coquelet	Special filter demodulator for Coquelet signals

Table 23: Demodulator Types

Various parameters are available for every demodulator type. Some demodulators allow for changes in their symbol tables, i.e. modification of the symbol values produced by the demodulator in question.

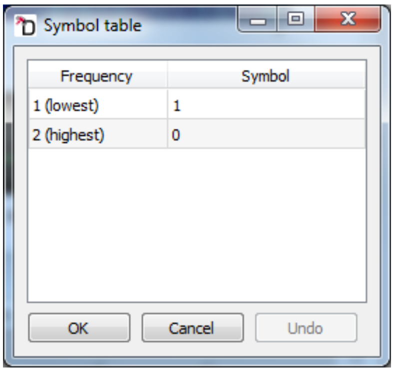


Figure 47 Demodulator Table of Symbols

Decoder Selection

The results of the demodulation process are symbols. These symbols can be decoded using an appropriate decoder. To do so, select the appropriate decoder from the list of decoders in the tab <*Decod*>. Additionally, decoders can be edited by means of the decoder editor.

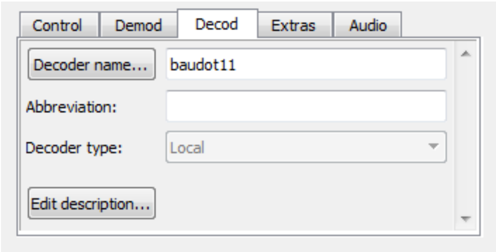


Figure 48 Parameters for Decoder Selection

The following table explains the parameters of the decoder selection.

Parameter	Function
Decoder name… **Decoder channel A/B…**	Specifies the name of the applied decoder. Activate the button <**Decoder Name…**> to open the dialog for selection of a decoder from a list of decoders Decoder Channel A/B… is only available if the demodulator type is set to F6/F7B: Channel A refers to the F6/F7B channel. By choosing the F7B mode “Morse/Data”, Channel A is a Morse channel and Channel B is a data channel. Please note: Manual entries of the decoder name will cause the system to verify the existence of this decoder in the list of decoders. Please observe the decoder type.
Abbreviation (A/B)	Defines the abbreviation of the decoder. The maximum input is five digits.
Decoder type (A/B)	Displays the setting of the decoder type. If go2DECODE has a database connection, the decoder type can be changed to Local or Database in the list of decoders. Local: Decoder from SDA computer Database: Decoder from database The decoders are stored on the computer of the APC.
Edit description...	This button calls the decoder editor. If the decoder source code belonging to the decoder exists, it will be loaded automatically.

Table 24: Decoder Parameters

On selection of a decoder using the button <**Decoder name…**>, the list of decoders will be displayed:

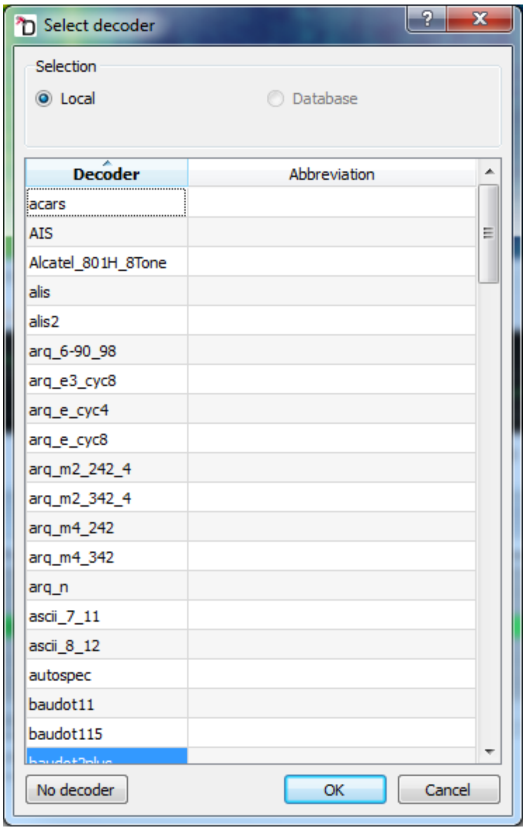


Figure 49 List of Decoders

This list shows the names of all decoders together with their abbreviations. The two radio buttons ⦿ *Local* and ⦿ *Database* are not relevant unless go2DECODE operates within a system that includes a database. Select the desired decoder via double click, or use the up/down keys on the keyboard to move in the list and press <**OK**> to confirm your selection. Activating the button <**No decoder**> will remove the decoder from the modem. To exit the selection, click the button <**Cancel**>.

Protected Decoders

Specific decoders may be subject to license restrictions, i.e. they are protected and can only be run on Application installations licensed for this purpose. As there is no source code available for these decoders, it is impossible to view or edit them by using the Decoder Editor.

Tab Extras for Modem Parameter Setting

The tab <*Extras*> features modem parameters that are impossible to assign to any demodulator or decoder parameters. The following table describes these general modem parameters:

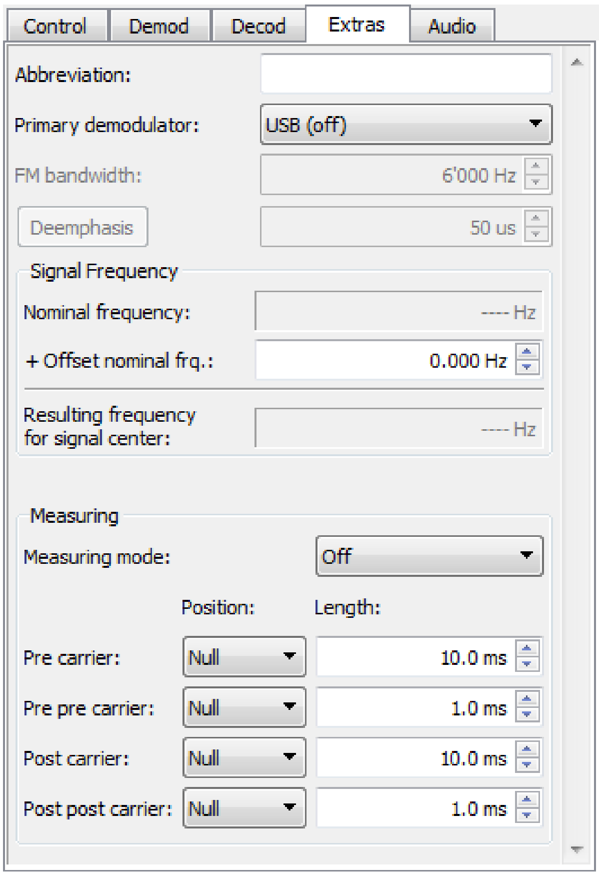


Figure 50 Modem Parameter Setting

Parameter	Function
Abbreviation	Defines the abbreviation of the modem. The maximum input is 5 digits.
Primary demodu-lator	Type of primary demodulation (USB, LSB, AM, FM)
FM bandwidth	Input signal bandwidth for the speech demodulator operating in Voice mode FM
<Deemphasis>	All FM systems adopt a system of emphasis where the higher frequencies are increased in amplitude before being used to modulate the carrier. At the receiver, the higher frequencies must be deemphasized in order to recover the original baseband signal. This is done by ac-tivating <Deemphasis>.
Deemphasis box	Defines the time constant used for deemphasis. For European FM radio, this is usually 50 µs and for US radio 75 µs.
Nominal Frequen-cy **+ Offset nominal freq.**	This spin box serves to specify a signal position deviation from the ideal position, i.e. a nominal frequency offset to the "internal" nominal frequency, for the current modem (Hz). The resulting nominal frequency is then the one used by the primary modulator. This fea-ture requires that the parameter Signal Search on the <*Control*> tab is set to Nominal Fre-quency. Bear in mind the above varies for AM, FM, and LSB.
Resulting fre-quency for signal centre	Sum of the value of the field *Nominal frequency* and *Offset nominal frequency*. The fre-quency depends on the set up of the demodulator.

Table 25: Modem Parameters

Tab Audio for Audio Out Parameter Setting

The tab <*Audio*> features parameters for Audio Out of signals (signal type *IF Unbuffered)*. First of all, these are the parameters for the voice (speech) demodulator converting the digital IF signal into a digital AF signal. Further, the resulting AF signal can be amplified either automatically or manually by the gain control parameters.

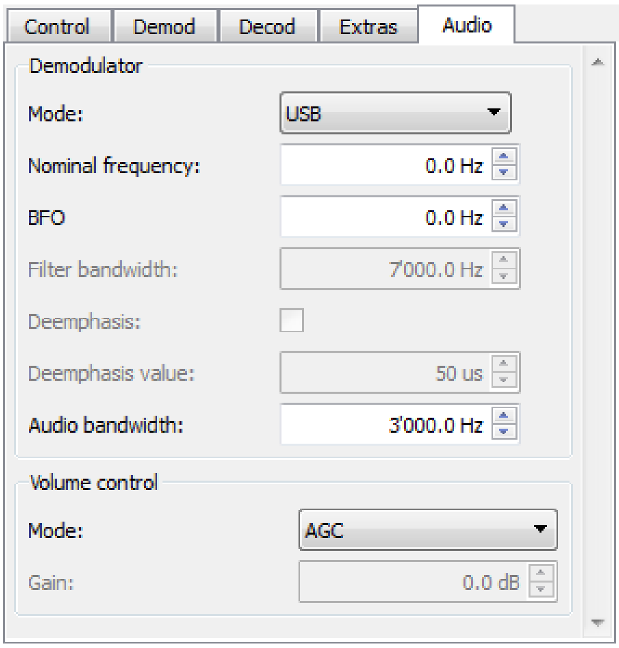


Figure 51 Audio Parameters

Parameter	Function
Demodulator	
Mode	Operating mode of the voice (speech) demodulator USB Upper one-side band modulation LSB Lower one-side band modulation AM Two-side band amplitude modulation FM Frequency modulation
Nominal frequency	Defines the frequency of the audio signal to be listened to (Hz). This is the centre frequency for AM and FM signals, respectively the upper and lower frequency for one-side-band modulated signals.
BFO	Defines the frequency of the oscillator used to create an audible frequency signal for one-side-band modulated signals (mode USB, LSB) (Hz)
Filter bandwidth	Defines the bandwidth of FM signals (FM mode only) (Hz)
☑ Deemphasis	All FM systems adopt a system of emphasis where the higher frequencies are increased in amplitude before being used to modulate the carrier. At the receiver, the higher frequencies must be deemphasised in order to recover the original baseband signal. This is done by activating <Deemphasis>.
Deemphasis box	Defines the time constant used for deemphasis. For European FM radio, this is usually 50 µs and for US radio 75 µs.
Audio bandwidth	Defines the bandwidth of the demodulated audio signal to be listened to (Hz)
Gain Control	
Mode	Defines whether to use automatic (AGC) or manual (MGC) signal amplification
Gain	Defines the degree of amplification in MGC mode (dB)

Table 26: Audio Parameters

To activate *Audio Out,* click the speaker icon 🔊 on the toolbar or use the menu item *Extras – Audio Out*.

Port Configuration

go2DECODE accepts ports between 41001 and 49150. If these ports are used by another program go2DECODE will not work. For details see ANNEX 1 Port Configuration.

Sound Configuration

go2DECODE supports the use of several sound output devices, i.e. standard and multi-channel sound cards featuring e.g. different numbers of channels.

For details see ANNEX 2 Sound Configuration.

SDA Signal Displays

The signal displays have numerous different tasks depending on the operating condition of go2DECODE.

When the *Automat* is on, the displays serve to monitor the input signal and to verify the result. In manual production (i.e. the *Automat* is off and the APC attempts to produce results with a modem selected manually) all display functions are enabled, such as:

- Monitoring of the input signal
- Measuring of signal parameters, for example modulation type, symbol rate, modulation order
- Quantification of the signal and demodulation quality
- Identification of the modem parameters in the signal as well as in the demodulated bit stream

Displays and Signal Types Available

The following displays are available:

Display	Application
Spectrum/Sonagram	Monitoring of input signal, measuring of bandwidth, measuring of signal start or signal end, burst length measuring, measuring of the shift in FSK, etc.
Spectrum Display	Frequency and level measuring (resolution to MHz range), quadrature for identification of PSK signals, etc.
Constellation Display	Determination of the version in PSK, modulation order in PSK/QAM, etc. The function *difference phase* produces a vertical display, even if the parameter setting for the signal centre is not perfect.
Eye Time pattern Display	Verification of the symbol rate and the signal quality as well as measuring on the time signal (oscilloscope)
Analysis Display	Simultaneous magnitude, frequency and phase measuring
Hell Display	Identification of frames, patterns, etc. by means of the intermediate results of a demodulator, as well as measuring of the symbol rate.
Bit Display	Identification of frames, patterns, synchronous words, etc. of the demodulated signals

Table 27: Display Types

Examples of signal analysis

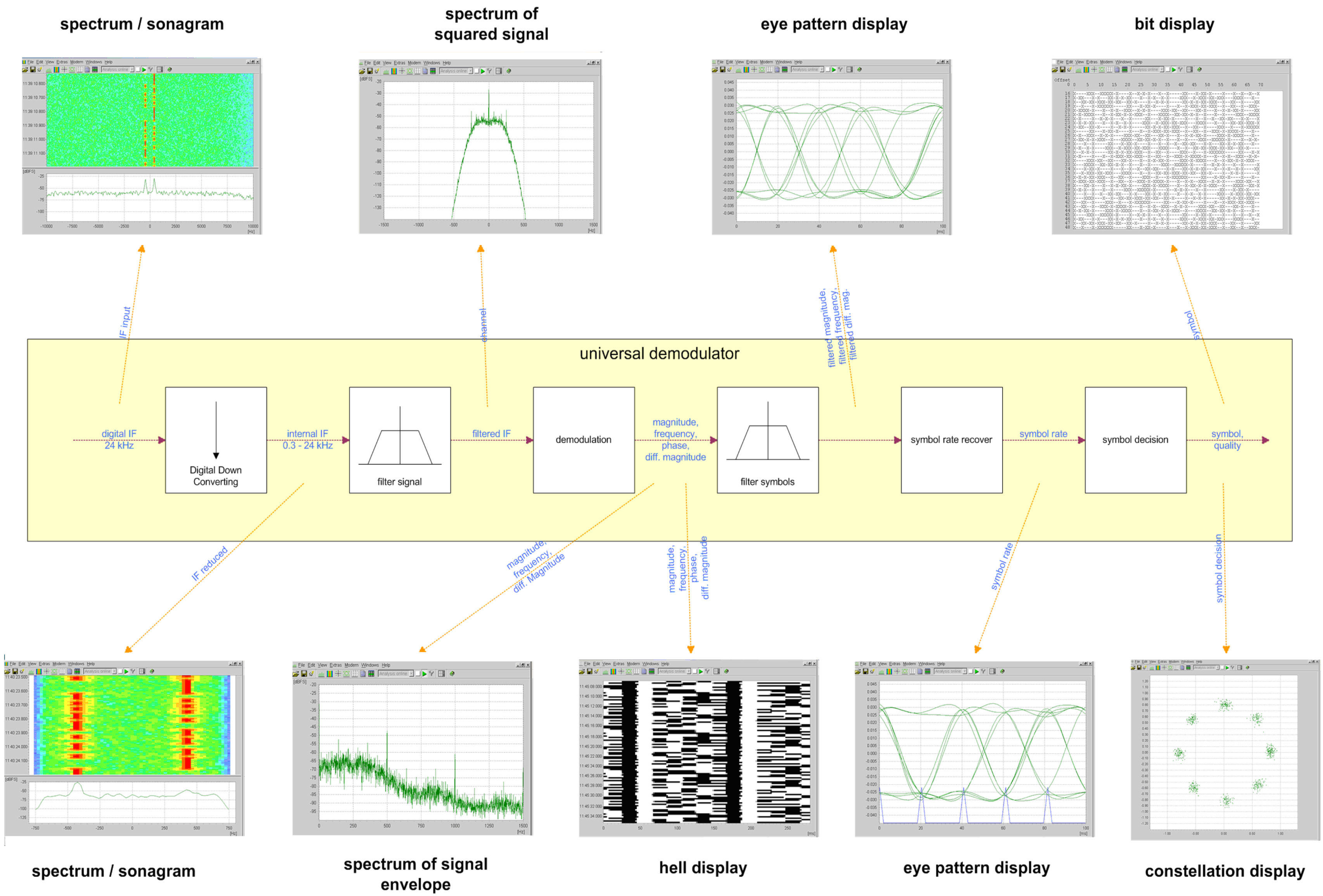


Figure 52 Examples of Signal Analysis with this Application

Signal processing with the SDA

Signal processing is done in several steps.

- Recording of the signal (A/D conversion, sound card, WAV file, etc)
- Filtering
- Demodulation
- Decoding

Each step supplies temporary results (for example internal IF signals, demodulated bits, etc.) which can be selected as a signal to be displayed in order to verify the processing or to analyze the signal information. Each display is adjusted separately by means of the *Input Signal* parameters.

The following table explains the different input signals:

Input Signal	Description
IF unbuffered	Intermediate frequency before being stored into the short term memory. Used to check the input signal.
IF input	Intermediate frequency at the input of the signal processing. Used to check the input signal. Signal times depend on the internal detection of the signal and identification of a modem in the APC.
Primary demod. AM/FM I	Primarily demodulated signal.
IF reduced	Additional internal intermediate frequency. The bandwidth of the signal has been roughly adapted according to the selected symbol rate. Used to check the demodulator setting.
Channel	The signal after the channel filter. Only signal relevant signal components are available. Also used to check the demodulator settings.
AGC | AFC	QAM and PSK demodulators have a frequency control (AFC) and a level control (AGC) whose function can be checked by means of this input signal.
Magnitude	Amplitude demodulated input signal (AM). Shows the energy loss of the signal.
Difference magnitude	Especially the FSK2 matched demodulator uses two channels and therefore has two AM signals. The difference between these two signals can be verified using this input signal.
Phase	Phase demodulated input signal (PM).
Frequency	Frequency demodulated input signal (FM).
Filtered magnitude	Filtered amplitude demodulated input signal.
Filtered difference magnitude	Difference between the two filtered AM signals.
Filtered frequency	Filtered frequency demodulated input signal.
Symbol decision	Signal prepared for symbol decision
Symbol rate	Symbol rate pins of the samples as input signal
Equalizer	The equalizer identifies and calculates distortions from the channel signal. Used to check the equalizer.
Symbols	Output of the demodulator

Table 28: Input Signal Parameters

The analysis of the intermediate signals after the individual process steps not only serves to check the demodulator functions but also enhances the range of available analyzing methods. For example, periodical fluctuations in the signal energy (and thus the symbol rate) can be measured using the input signal magnitude with the help of the spectrum. Another example is to use the input filter of the demodulator. The input signal can be used for the separation of the signal to be analyzed from a signal mix (elimination of distortions).

The availability of the input signals depends on the demodulator selected, as some demodulators will not calculate every signal, and some displays cannot display every signal. The following table shows the possible combinations.

Demodulator → **Input Signal ↓**	Voice	Morse	ASK 2	FSK 2, 4 discr.	FS 2 matched	(G)MSK	DPSK 2, 4, 8 A/B	PSK 2, 4, 8 A/B	Multitone (FSKn)	MFSK 2	MDPSK 2, 4 A/B	MPSK 2, 4, 8 A/B	LINK-11	ASK2PSK8	ASK4PSK8	QAM 16	TFM 3	Clover	Pactor II/III	OFDM	F6/F7B	OQPSK
IF Unbuffered Q/I	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
IF Unbuffered	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IF Input Q/I	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
IF Input	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Primary demod AM/FM I	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
IF reduced Q/I	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
IF reduced	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Channel Q/I			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Channel			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
AGC | AFC Q/I							●	●				●		●	●	●						
AGC | AFC							●	●				●		●	●	●						●
Magnitude			●						●									●	●		●	
Diff. Magnitude					●																●	
Phase						●	●				●		●				●	●				
Frequency				●		●			●	●							●	●				
Filtered magnitude			●						●													
Filtered diff. magnitude					●																●	
Filtered Frequency				●		●			●	●							●					
Symbol Decision Q/I							●	●			●	●	●	●	●	●		●				
Symbol Decision							●	●			●	●	●	●	●	●		●				●
Symbol Rate			●	●	●	●	●	● ✓	●	●	●	●	●	●	●	●	●	●			●	
Equalizer Q/I						●	●	●				●		●	●	●	●					
Equalizer						●	●	●				●		●	●	●	●					●
Symbols		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			●	●	

Table 29: Input Signal and Demodulator Combinations

Display → **Input Signal ↓**	Spectrum	Spectrum / Sonagram	Constellation Display	Eye Pattern Display	Bit Display	Hell Display	Analysis Display
IF Unbuffered Q/I				●		●	
IF Unbuffered	●	●	●				●
IF Input Q/I				●		●	
IF Input	●	●	●				●

Display → Input Signal ↓	Spectrum	Spectrum / Sonagram	Constellation Display	Eye Pattern Display	Bit Display	Hell Display	Analysis Display
Primarydemod AM/FM I	●	●		●			
IF reduced Q/I				●		●	
IF reduced	●	●	●				●
Channel Q/I				●		●	
Channel	●	●	●				●
AGC | AFC Q/I				●		●	
AGC | AFC	●	●	●				
Magnitude	●	●		●		●	
Diff. Magnitude	●	●		●		●	
Phase				●		●	
Frequency	●	●		●		●	
Filtered magnitude				●		●	
Filtered diff. magnitude				●		●	
Filtered Frequency				●		●	
Symbol Decision Q/I				●		●	
Symbol Decision	●	●	●				
Symbol Rate				●		●	
Equalizer Q/I				●		●	
Equalizer	●	●	●				
Symbols					●		

Table 30: Input Signal and Display Combinations

Displays of the SDA

Spectrum/Sonagram Display

The spectrum/sonagram display serves to monitor the input signal. It displays both the individual spectrum and several spectrums in the duration of a signal.

The following figure shows an example of the spectrum/sonagram display.

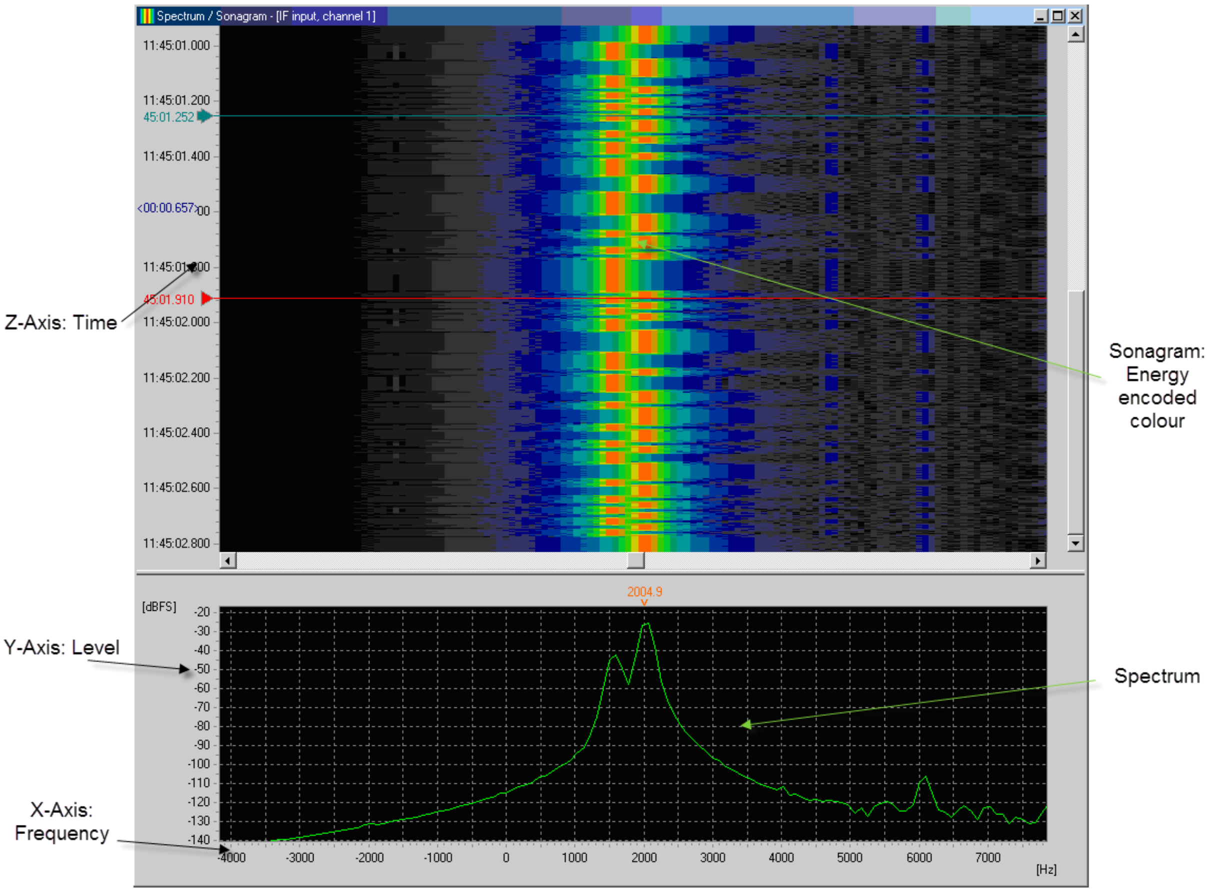


Figure 53 Spectrum / Sonagram Display

The spectrum/sonagram display is subdivided into two windows.

The upper window shows the time curve of the individual spectrums. Each spectral line is displayed as an individual row. The color shows the energy in this frequency (from black → blue → green → red). The labels on the time axis (Z-axis) show the recording period of the signal. Changes in the signal level in the course of time can be identified by changes in color.

In the lower window of the display, the spectrum, an X-axis is drawn for the frequencies. Frequency 0 corresponds to the parameter *signal frequency* set in DANA. All negative frequencies are below the signal centre; all positive frequencies are above the signal centre.

The energy is drawn on the Y-axis. The energy is displayed in the spectrum as the logarithm of the measure (dB).

The unit of the spectrum is dBFS. This refers to the gain of the signal. 0 dB full scale and –100 dB means 100 dB below full gain.

The spectrum/sonagram display with IF input signal provides an overview of the total energy of the signal and displays the noise range of the signal.

The values of frequency, level and time can be measured by use of cursors.

Spectrum/Sonagram-Specific Display Controls

The spectrum/sonagram has various special features to facilitate the navigation within the signal display.

To use the keyboard shortcuts, make sure the GUI focus is actually on the sonagram display, as indicated by the blue title bar.

Scrollbars

The display window features a scrollbar each in frequency direction and in time direction (provided the signal exceeds the display section). In addition to the common drag functions, there are several keyboard shortcuts for scrollbar operations:

Parameter	Function
Mouse Wheel	Move scrollbar in time direction
<Shift> + Mouse Wheel	Move scrollbar in frequency direction
<Right Arrow>	Move frequency scrollbar to the right
<Left Arrow>	Move frequency scrollbar to the left
<Up Arrow>	Move time scrollbar up (closer to the start)
<Down Arrow>	Move time scrollbar down (closer to the end)
<Page Up>	Move time scrollbar up one page towards the start
<Page Down>	Move time scrollbar down one page towards the end
<Home>	Move time scrollbar up to the start
<End>	Move time scrollbar down to the end

Table 31: Spectrum/Sonagram Display Control Scrollbars

Zoom Functions

The sonagram software provides convenient zoom functions for quick navigation and analysis. The default zoom factor is 2, respectively its reciprocal in opposite direction. Custom zoom factors can be set on the display's property sheet on the *<Cursor>* tab (spin box *Relative Zoom Factor).*

Parameter	Function
<Ctrl> + Mouse Wheel	Zoom in/out (no cursors activated)
<+>	Zoom in With enabled cursors, the keyboard shortcut <+> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the shortcut <+>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<->	Zoom out Each time the keyboard shortcut <-> is activated, the display area is enlarged by factor 2. With disabled cursors the zoom is made in X-direction only.

Table 32: Spectrum/Sonagram Display Control Zoom Functions

Popup Menu

The spectrum/sonagram display provides a popup menu with a number of useful items:

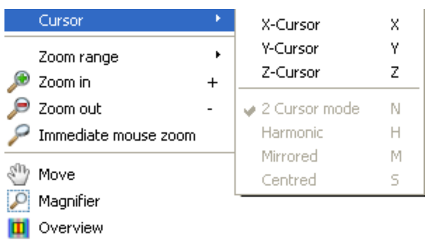


Figure 54 Spectrum/Sonagram Popup Menu

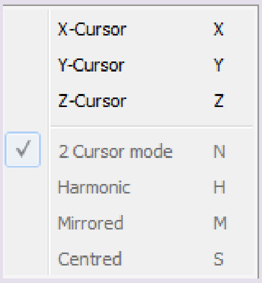
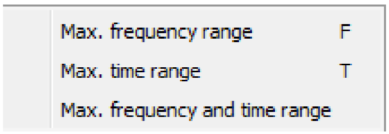
Parameter	Function
Cursor ▸	Activate and deactivate X-, Y-, Z- and Harmonic cursors 
Zoom Factors ▸	Max. Frequency Range Zoom to maximum frequency range Max. Time Range Zoom to maximum time range (show entire buffer without scrollbar) 
Zoom in	Enlarged view of the section delimited by the cursors. Repeat this process until the spectrum area displayed is satisfactory.
Zoom out	Reduced view of the section delimited by the cursors. Repeat this process until the spectrum area displayed is satisfactory.
Immediate Zoom	Zoom in by clicking the mouse at the desired position (zoom out using the <Ctrl> key)
Move	The mouse pointer changes into a hand. Drag the displayed section in the desired direction by moving the mouse while keeping the left mouse button pressed.
Magnifier	The mouse pointer changes into a magnifying glass superimposed on a rectangle. On mouse click, a separate window is opened showing the magnified contents of the sonagram display centre. Select the section to magnify, either by drawing a rectangle before activating the magnifier function or simply clicking the position of interest in the sonagram display. -
Overview	Opens a sonagram with an overview of the complete signal located in the buffer. In addition you see a rectangular mark around the section in the actual sonagram display.

Table 33: Spectrum/Sonagram Popup Menu Parameters

Keyboard Shortcuts

In summary, the following keyboard shortcuts are available in the spectrum/sonagram display:

Shortcut	Function
Mouse Wheel	Move scrollbar in time direction
<Shift> + Mouse Wheel	Move scrollbar in frequency direction
<Right Arrow>	Move frequency scrollbar to the right
<Left Arrow>	Move frequency scrollbar to the left
<Up Arrow>	Move time scrollbar up (closer to the start)
<Down Arrow>	Move time scrollbar down (closer to the end)
<Page Up>	Move time scrollbar up one page towards the start
<Page Down>	Move time scrollbar down one page towards the end
<Home>	Move time scrollbar up to the start
<End>	Move time scrollbar down to the end

Shortcut	Function
<+>	Zoom in
<->	Zoom out
<x>	Activate and deactivate X-cursors (toggle function)
<y>	Activate and deactivate Y-cursors (toggle function)
<z>	Activate and deactivate Z-cursors (toggle function)
<h>	Activate and deactivate Harmonic cursors (toggle function)

Table 34: Spectrum/Sonagram Display Keyboard Shortcuts

Parameter Setting

As with all displays, the spectrum/sonagram's parameters are edited on the property sheet, which features several tabs.

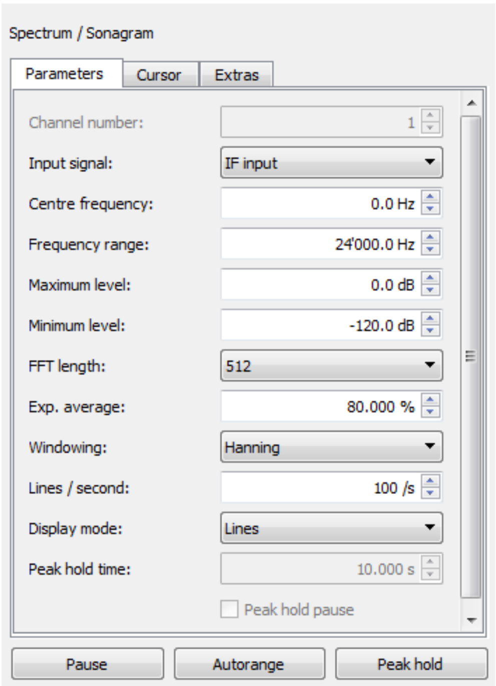


Figure 55 Spectrum/Sonagram Parameters Tab

To show the parameters of the spectrum/sonagram, select the tab *Parameters*.

The following parameters are available:

Parameter	Function
Channel Number	There are signals that consist of several signal parts, e.g. the input signal channel in an MFSK2 modem. The channels of such signals are selected as the input signal by their channel number.
Input signal	Use this parameter to select the input signal of the display. If the automatic production is active, you can only select the input IF. While setting the parameters of the demodulator, it may occur that a previously selected input signal is no longer available. In this case, the selection *no signal* will be displayed.
Centre frequency	The frequency section to be viewed is set in combination with the frequency range. The centre frequency is the centre of the section.
Frequency range	The frequency section to be viewed is set in combination with the centre frequency. The frequency range is the range within the section. The zoom can thus be set manually.
Maximum level	Definition of the level range in the spectrum display. The maximum level is the upper end

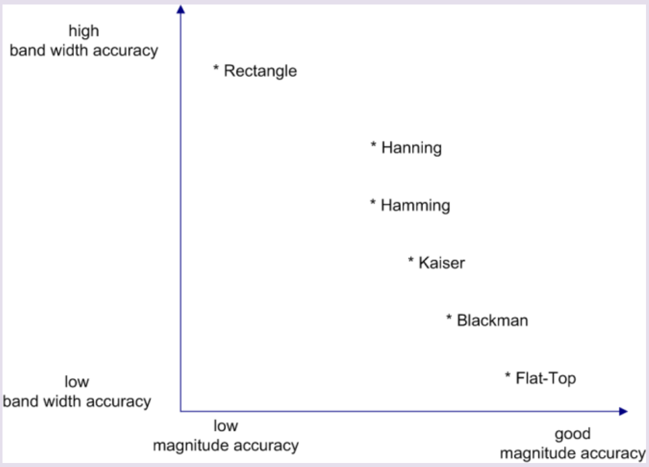
Parameter	Function
	of the section.
Minimum level	Definition of the level range in the spectrum display. The minimum level is the lower end of the section.
FFT length	Number of values of frequency in which the signal is displayed. To obtain a higher resolution of the displayed frequency range, increase the FFT length.
Exp. average	The spectrum is displayed in average of several spectrums. The result of a change of the spectrum will be a total view of the spectrum. 0%: No average - 80%: Low average 80% - 99%: High average 100%: No updating of the spectrum
Windowing	The FFT algorithm is used for the calculation of the spectrum. This algorithm, however, shows inaccuracies in the amplitude (attenuation) as well as in the bandwidth (expansion) of a signal due to the finite signal probe. These inaccuracies can be reduced using windowing: 
Lines / second	Number of spectrums that can be calculated and displayed within one second. This parameter serves to set the time resolution for the sonagram, thus also setting the scroll speed.
Display mode	In mode Line, the spectrum is displayed as a closed curve. In mode Beam, the individual values are displayed as bars.
Peak hold time	When the time adjusted has elapsed, the peak hold (the red curve in the spectrum) will be reset by setting on the current spectrum. 0 means no reset.
☑Peak hold pause	This checkbox serves to freeze the continuous display after a period specified in the spin box Peak Hold Time (button <**Pause**> is activated and locked). It can only be ticked if the button <**Peak Hold**> has been activated. This function will not stop the signal flow between the signal processing modules. To reactivate the continuous update of the display, press the button <**Pause**> again (toggle switch).
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude and frequency range. The mode Autorange analyzes approx. 12 spectral lines. The display is adapted on every change of the range. On pressing <**Autorange**> again, the process will be deactivated (toggle).
<Peak hold>	By activating Peak Hold, the maximum energies in the spectrum are recorded and displayed as a red curve.

Table 35: Spectrum/Sonagram Parameters Tab Parameters

Cursors

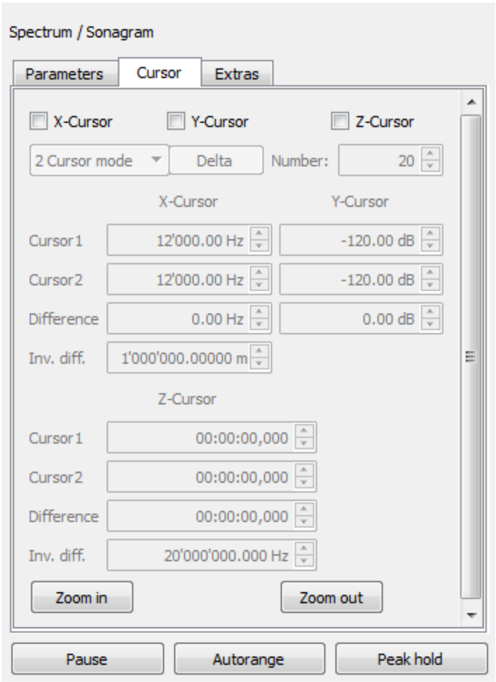


Figure 56 Spectrum/Sonagram Display Cursor Tab

The <*Cursor*> tab accommodates all functions related to cursor operations except for the *Zoom* buttons and the relative zoom factor setting. These are located on the <*Extras*> tab of the Spectrum/Sonagram Display.

Additionally, the spectrum/sonagram display features a popup menu and keyboard shortcuts (<**x**>, <**y**>, <**z**>, <**h**>) serve to enable and disable the X-, Y-, Z-cursors and Harmonic cursors.

Parameter	Function
☑ X-Cursor	The cursors are activated/deactivated in X-direction. They are used to measure values of time.
☑ Y-Cursors	The cursors are activated/deactivated in Y-direction. They are used to measure the values on the Y-axis (which varies from display to display, i.e. phase, frequency, etc.).
☑ Z-Cursor	The cursors are activated in Z-direction. They are used to measure values of time.
Dropdown Menu	2 Cursor mode 2 independent, moveable cursors will be displayed in the window. Harmonic Several cursors are activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor. The Harmonic function can only be applied in combination with X-cursors, Y-cursors or Z-cursors. It serves to measure repeating intervals. Mirrored Several cursors are activated at equidistant intervals. Cursor 1 will be on one side and in the middle of the even-numbered equidistant cursor and the odd-numbered equidistant cursor is located on the other side.. If you move one cursor (except cursor 1) all other cursors besides cursor 1 will move symmetrically. Centred Several cursors are activated at equidistant intervals. In contrast to <Mirrored>, all cursors (except cursor 1) and the cursor which is in the opposite of the first mirrored cursor are moving.
<Delta>	This button serves to insert a specific number of numbered cursors (Number – 2) at equidistant intervals in the area delimited by Cursor1 and Cursor2. Once selected, the button is disabled and the checkbox ☑ Harmonic is ticked. This feature allows for convenient activation of the Harmonic function for specific areas without the need to adapt the cursors. To cancel

Parameter	Function
	the additional cursors, deactivate the checkbox ☑ Harmonic. Doing so, please note that Cursor2 will take the position of the first additional cursor.
Number	Use this spin box to determine the number of cursors to be displayed in Harmonic mode.
Cursor1	Coordinates of the first X-, Y- and Z-cursor each
Cursor2	Coordinates of the second X-, Y- and Z-cursor each
Difference	Difference between Cursor1 and Cursor2
Inv. diff.	Inverted difference is a helpful function for direct readout of symbol rate (determination of which is a major purpose of the Z-cursors) according to the formula 1 / [value in box Difference]
Cursor1	Coordinates of the first X and Y Cursor each
Cursor2	Coordinates of the second X and Y Cursor each
Difference	Difference between Cursor1 and Cursor2
Inv. diff.	Inverted difference is a helpful function for direct readout of symbol rate (determination of which is a major purpose of the Z-cursors) according to the formula 1 / [value in box Difference]
<Zoom in>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Zoom out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude, frequency and phase range. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <Autorange> again, this process will be deactivated (toggle).
Peak Hold	By activating Peak Hold, the maximum energies in the spectrum are recorded and displayed as a red curve.

Table 36: Spectrum/Sonagram Cursor Tab Parameters

Extras

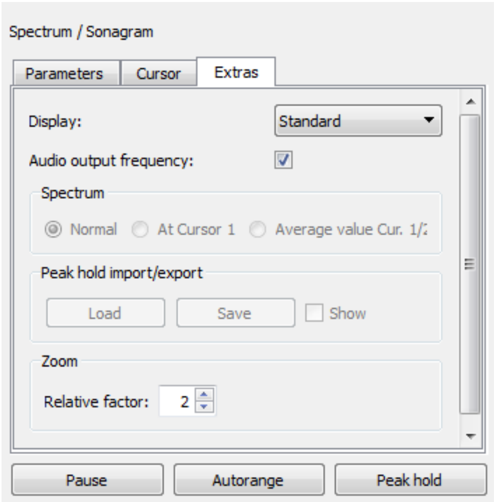


Figure 57 Spectrum/Sonagram Display Extras Tab

Apart from the common color scheme options, the <*Extras*> tab features the checkbox ☑ *Audio output freq.* This box is ticked by default to insert a cursor in the Spectrum/Sonagram Display. Drag this cursor to the desired frequency for audio output. The current frequency value is displayed above the cursor.

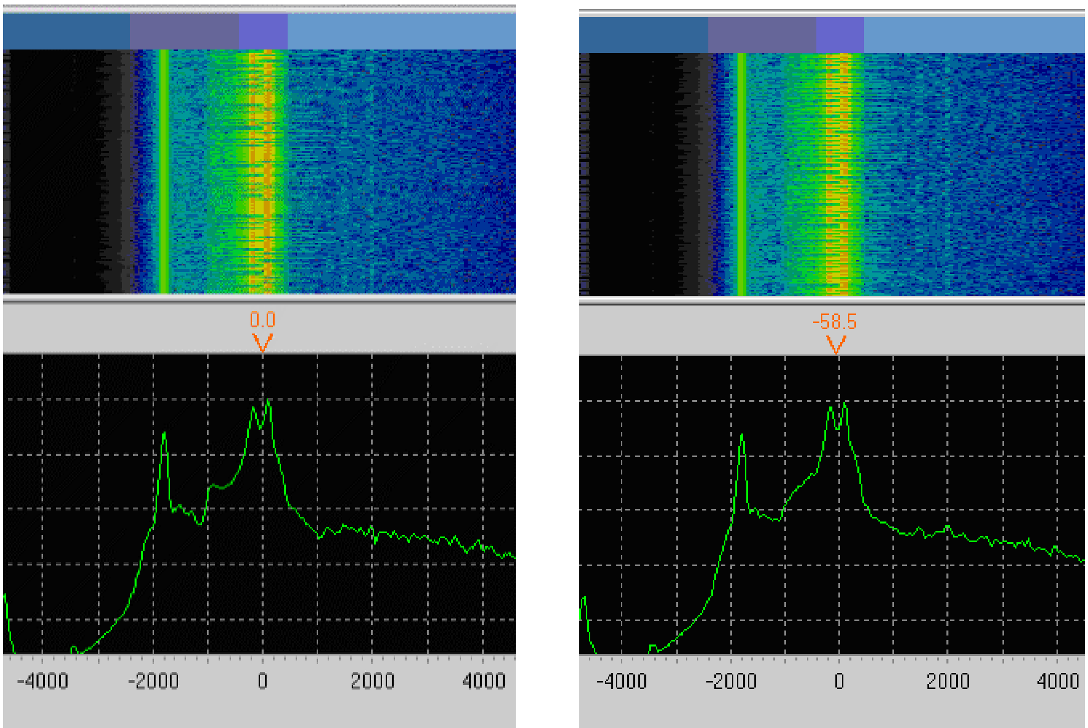


Figure 58 Cursor for Selection of Audio Output Frequency

Activate or deactivate this checkbox as required. When reinserted, the cursor appears at its previous position. To reset the frequency value to zero (or any other value), use the spin box *Nominal frequency* on the <*Audio*> tab of the property sheet.

Additionally the <*Extras*> tab has a group box *Spectrum,* which is inactive unless the Z-cursors are enabled. Specify whether you wish to display

- The spectrum usually averaged exponentially (⦿ *Normal)*
- The spectrum exactly at the position of Cursor1 (⦿ At Cursor 1)

- The spectrum averaged between the two cursors (⦿ Average value Cur. 1/2).

The group box *Peak Hold* is disabled until the button <**Peak Hold**> is selected. The checkbox ☑ *Pause* serves to freeze the current display after the period entered in the spin box *Time:* (the button <**Pause**> is selected). This function will not stop the signal flow between the signal processing modules. Re-activate the current update of the display by selecting the button <**Pause**> again (toggle switch).

The group box *Peak-Hold Import/Export* serves to save and load peak hold curves for accurate comparison. The two functions are inactive unless the buttons <**Pause**> and <**Peak Hold**> are selected.

The curves are stored in *.csv* format *(Comma Separated Value),* which is editable in Microsoft Excel or a suitable editor such as e.g. Microsoft WordPad. When loading a saved curve, it is inserted in the spectrum display as a yellow line. The checkbox ☑ *Show* is not active unless a curve has been loaded.

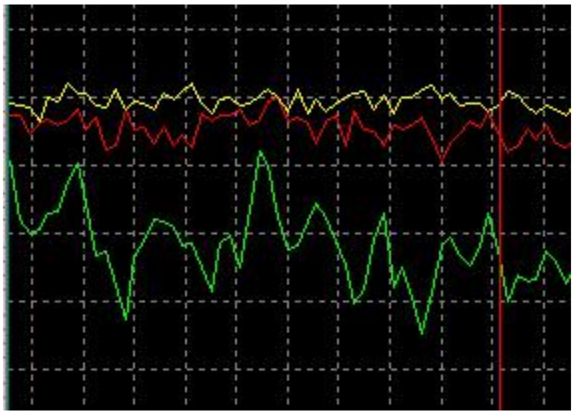


Figure 59 Loading of a Curve for Comparison

Please make sure to display the inserted curve using the original FFT length or an adjacent FFT length.

The group box *Zoom* accommodates the controls for zoom operations.

The following parameters are available:

Parameter	Function
<In>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, zooming by rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
Relative factor	Enter the desired relative zoom factor for zooming out and its reciprocal for zooming in. The default value in this spin box is 2.

Table 37: Spectrum/Sonagram Extras Tab Parameters

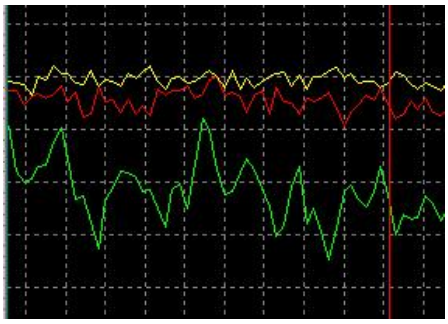


Figure 60 Peak Hold Comparison

Spectrum Display

The spectrum displays the distribution of the energy with individual values of frequency, just as the spectrum/sonagram display does.

The spectrum display is used for separation of signal and noise. The frequency and values of level can be measured using cursors. In contrast to the spectrum/sonagram display, the spectrum display allows for the setting of great FFT lengths, and the signal can be squared for analysis.

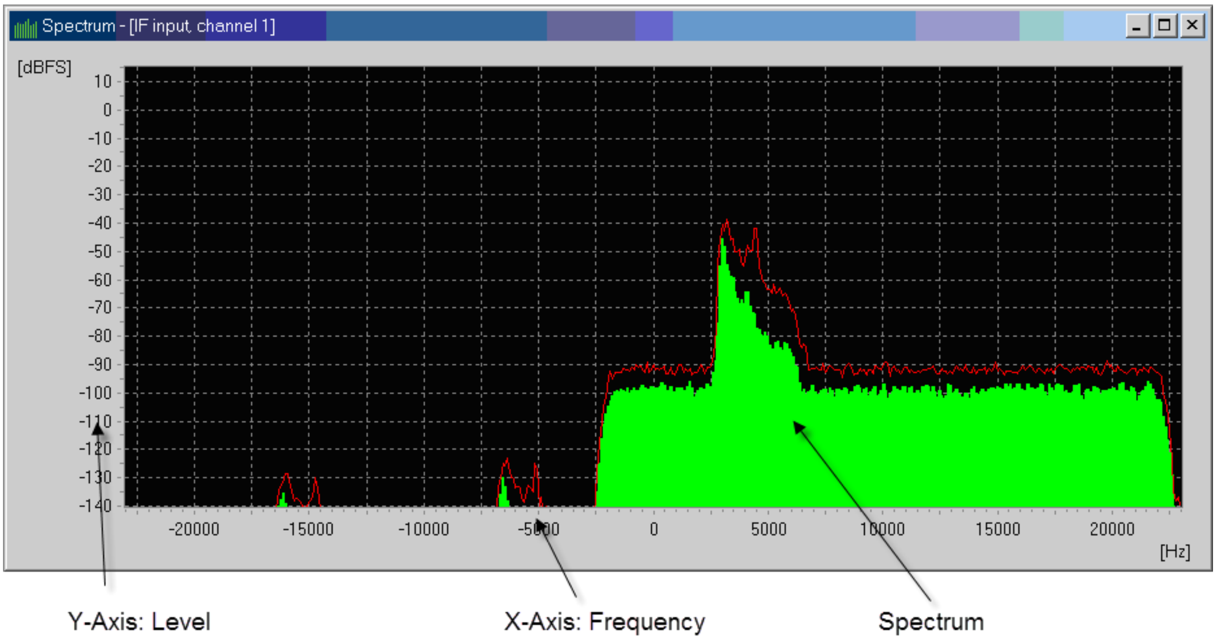


Figure 61 Spectrum Display

The parameters are edited via the property sheet as with all displays. They are distributed on several tabs.

Parameter Setting

The parameters of the spectrum are displayed by activating the tab <*Parameters*>.

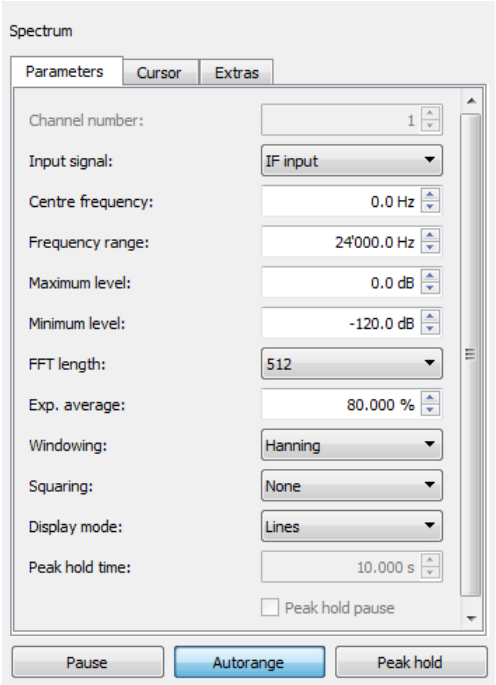


Figure 62 Spectrum Display Parameters Tab

The following parameters are available:

Parameter	Function
Channel number	There are signals that consist of several signal parts, e.g. the input signal Channel in an MFSK2 modem. By using the channel number the channels of such signals can be selected as the input signal.
Input signal	Use this parameter to select the input signal of the display. If the automatic production is active, you can only select the input IF. While setting the parameters of the demodulator, it may occur that a previously selected input signal is no longer available. In this case, the selection *no signal* will be displayed.
Centre frequency	The frequency section to be viewed is set in combination with the frequency range. The centre frequency is the centre of the section.
Frequency range	The frequency section to be viewed is set in combination with the centre frequency. The frequency range is the range within the section. The zoom can thus be set manually.
Minimum level	Definition of the level range in the spectrum display. The minimum level is the lower end of the section.
Maximum level	Definition of the level range in the spectrum display. The maximum level is the upper end of the section.
FFT length	Number of values of frequency in which the signal is displayed. To obtain a higher resolution of the displayed frequency range, increase the FFT length. Higher frequency-resolution numbers up to 65535 can be set in the spectrum.
Exp. average	The spectrum is displayed in average of several spectrums. The result of a change of the spectrum will be a total view of the spectrum. 0%: No average - 80%: Low average 80% - 99%: High average 100%: No updating of the spectrum
Windowing	The FFT algorithm is used for the calculation of the spectrum. This algorithm, however, shows inaccuracies in the amplitude (attenuation) as well as in the bandwidth (expansion) of a signal due to the finite signal probe. These inaccuracies can be reduced using windowing:

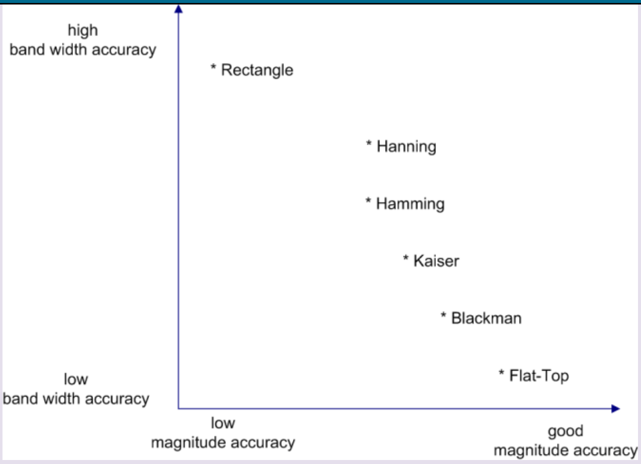
Parameter	Function
	
Squaring	Number of squaring operations applied to the time signal. Example: The modulation order (2 /4, 8) of PSK modems can be identified in a single (double, triple) squaring by the formation of a peak in the centre of the spectrum. Additionally, the symbol rate of such a modem can be seen by measuring the frequency interval between the main peak and the secondary peak. In this process, the frequency scaling must be taken in consideration, and the measured value must be multiplied by 2 or 4.
Display type	In mode Line, the spectrum is displayed as a closed curve. In mode Beam, the individual values are displayed as bars.
Peak hold time	When the time adjusted has elapsed, the peak hold (the red curve in the spectrum) will be reset by setting on the current spectrum. 0 means no reset.
☑ Peak-hold pause	This checkbox serves to freeze the continuous display after a period specified in the spin box Peak Hold Time (button <**Pause**> is activated and locked). It can only be ticked if the button <**Peak Hold**> has been activated. This function will not stop the signal flow between the signal processing modules. To reactivate the continuous update of the display, press the button <**Pause**> again (toggle switch).
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude and frequency range. The mode Autorange analyzes approx. 12 spectral lines. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).
<Peak hold>	On activation of Peak Hold, the maximum energies in the spectrum are recorded and displayed as a red curve.

Table 38: Spectrum Display Parameters Parameters

Cursor Setting

The cursor parameters are displayed by activating the <*Cursor*> tab of the respective display. You can thus insert cursors into the display, which serve to select or clarify specific display sections, or measure the signal data. The <*Cursor*> tab shows the coordinates of the individual cursor positions in editable spin boxes.

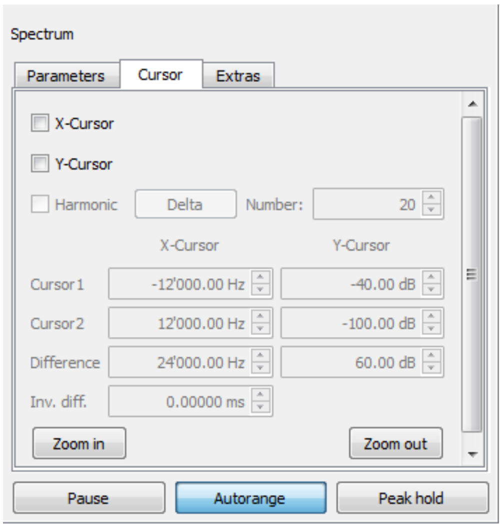


Figure 63 Spectrum Display Cursor Tab

The following parameters are available:

Parameter	Function
☑ X-Cursor	The cursors are activated/deactivated in X-direction. They are used to measure values of time.
☑ Y-Cursors	The cursors are activated/deactivated in Y-direction. They are used to measure the values on the Y-axis (which vary from display to display, i.e. phase, frequency, etc.).
☑ Harmonic	Several cursors are activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor. The Harmonic function can only be applied in combination with X-cursors, Y-cursors or Z-cursors. It serves to measure repeating intervals.
<Delta>	This button serves to insert a specific number of numbered cursors (Number – 2) at equidistant intervals in the area delimited by Cursor1 and Cursor2. Once selected, the button is disabled and the checkbox ☑ Harmonic is ticked. This feature allows for convenient activation of the Harmonic function for specific areas without the need to adapt the cursors. To cancel the additional cursors, deactivate the checkbox ☑ Harmonic. Doing so, please note that Cursor2 will take the position of the first additional cursor.
Number	Use this spin box to determine the number of cursors to be displayed in Harmonic mode.
Cursor1	Coordinates of the first X-, Y- cursor each
Cursor2	Coordinates of the second X-, Y- cursor each
Difference	Difference between Cursor1 and Cursor2
Inv. diff.	Inverted difference is a helpful function for direct readout of symbol rate (determination of which is a major purpose of the Z-cursors) according to the formula 1 / [value in box Difference]
<Zoom in>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Zoom out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude, frequency or phase range. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, the process will be deactivated (toggle).

Parameter	Function
Peak Hold	When activating Peak Hold, the maximum energies in the spectrum are recorded and displayed as a red curve.

Table 39: Spectrum Display Cursor Parameters

Extras

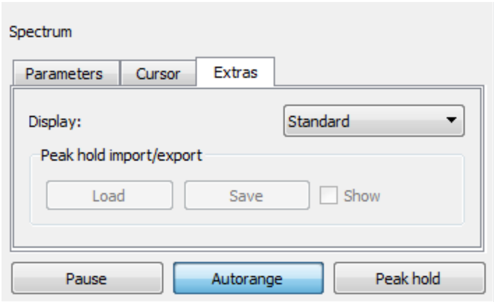


Figure 64 Spectrum Display Extras Tab

Apart from the common color scheme options the <*Extras*> tab on the property sheet provides the group box *Peak-Hold Import/Export,* which serves to save and load peak hold curves for accurate comparison. The two functions are inactive unless the buttons <**Pause**> und <**Peak Hold**> are selected.

The curves are stored in *.csv* format *(Comma Separated Value),* which is editable in Microsoft Excel or a suitable editor such as e.g. Microsoft WordPad. When loading a saved curve, it is inserted in the spectrum display as a yellow line. The checkbox ☑ *Show* is not active unless a curve has been loaded.

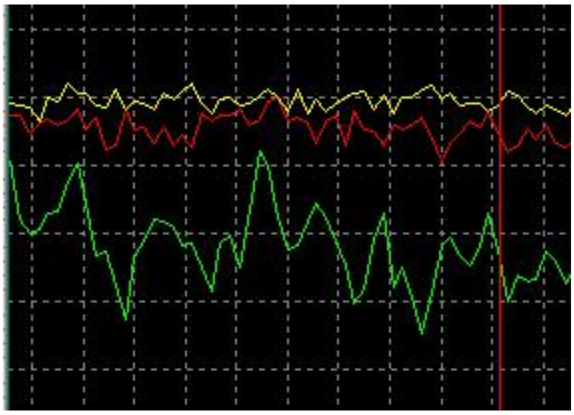


Figure 65 Curve to Compare with

Please make sure to display the inserted curve using the original FFT length or an adjacent FFT length.

Time/Eye Pattern Display

The eye pattern display indicates the course of the amplitude, the phase or the frequency during the period of time. As shown in the Figure, several signal sections can superimpose in one display.

The display has two operating modes: *Time display* and *eye pattern display*. If the system is set to *eye pattern display*, the signals are drawn synchronized with the symbol rate of the demodulator. In the operating mode *time display*, no synchronizing process will be carried out.

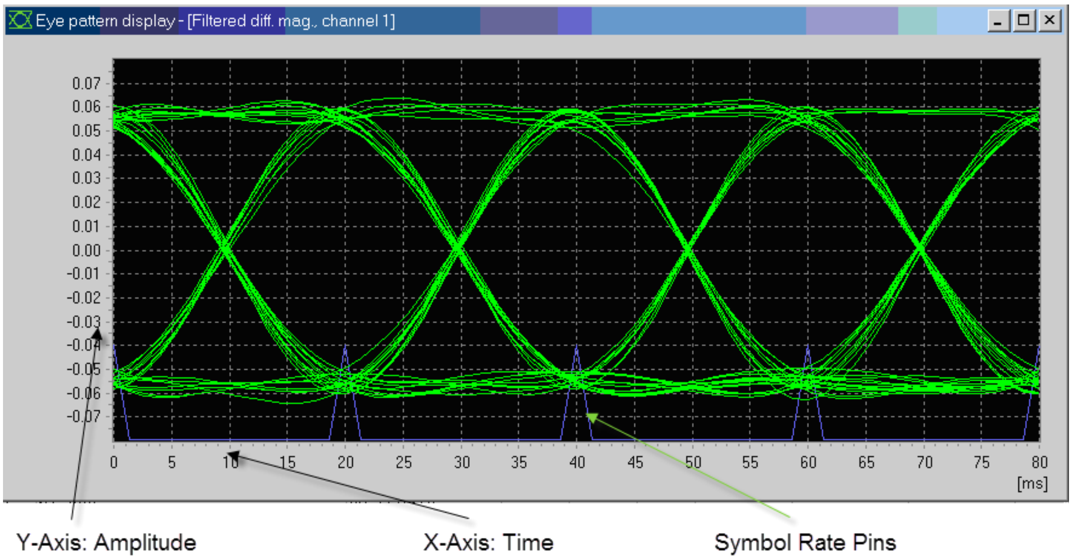


Figure 66 Eye Pattern Display

The display shows the time on the X-axis. The time 0 is the start of the signal section. Depending on the input signal selected either the amplitude, the phase (°) or the frequency (Hz) will be displayed on the Y-axis.

The eye pattern display provides an overview of the course of the signal during the time curve, and serves to monitor the signal symbol rate which is reconstructed by the demodulator. The values of time, amplitude, phase and frequency can be measured using cursors.

If several signal sections are drawn in synchronization one above the other by the symbol rate generated in the demodulator, "eyes" will be formed. The opening in the interior of the eye pattern indicates the quality of the demodulators or of the signal.

Parameter Setting

The parameters of the eye pattern display can be displayed by activating the tab <*Parameters*>.

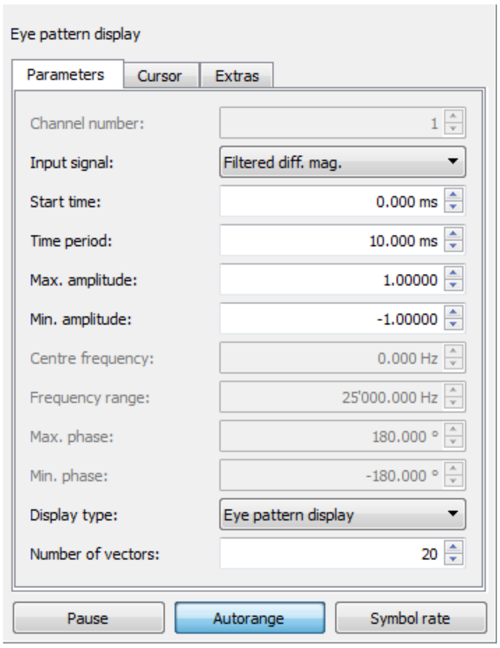


Figure 67 Eye Pattern Display Parameters Tab

The following parameters are available:

Parameter	Function
Channel number	There are signals which consist of several signal parts, e.g. the input signal channel in an MFSK2 modem. By using the channel number the channels of such signals can be selected as the input signal.
Input signal	Use this parameter to select the input signal of the display. If automatic production is active, only the input IF will be enabled. While setting the parameters of the demodulator, it may occur that a previously selected input signal is no longer available. In this case, the selection no signal will be displayed.
Start time	The period of time to be viewed is set in combination with the time period.
Time period	The period of time to be viewed is set in combination with the start time. A zoom thus can be set manually.
Max. amplitude	Definition of the amplitude range of the eye pattern display. The maximum amplitude is the upper end of the section. This parameter is not available if Freq., Freq. filtered or Phase has been selected as the input signal.
Min. amplitude	Definition of the amplitude range of the eye pattern display. The minimum amplitude is the lower end of the section. This parameter is not available if Freq., Filtered Frequency or Phase has been selected as the input signal.
Centre frequency	The frequency section to be viewed is set in combination with the frequency range. The centre frequency is the centre of the section. This parameter is not available unless Freq., Filtered Frequency or Phase has been selected as the input signal.
Frequency range	The frequency section to be viewed is set in combination with the centre frequency. The frequency range is the range within the section. The zoom can thus be set manually. This parameter is not available unless Freq., Filtered Frequency or Phase has been selected as the input signal.
Max. phase	Definition of the phase range of the eye pattern display. The maximum phase is the upper end of the section. This parameter is not available unless Phase has been selected as the input signal.
Min. phase	Definition of the phase range of the eye pattern display. The minimum phase is the lower end of the section. This parameter is not available unless Phase has been selected as the input signal.
Display type	Set the operating mode of the eye pattern display using this parameter. Time display: The signals are displayed in the chronology in which they are received. Eye pattern display: Time synchronization of the signals with the symbol rate is carried out before the signals are displayed.
Number of vectors	Sets the number of signals which are drawn one above the other. With this option, you can adjust the superimposing of the signal vectors, which is required in the eye pattern display.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude, frequency or phase range. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, the process will be deactivated (toggle).
<Symbol rate>	Switch the display of the symbol rate pins in the eye pattern display on and off (toggle function) by using this parameter.

Table 40: Eye Pattern Display Parameter Parameters

Cursor setting

The cursor parameters are displayed by activating the <*Cursor*> tab of the respective display. You can thus insert cursors into the display, which serve to select or clarify specific display sections, or measure the signal data. The <*Cursor*> tab shows the coordinates of the individual cursor positions in editable spin boxes.

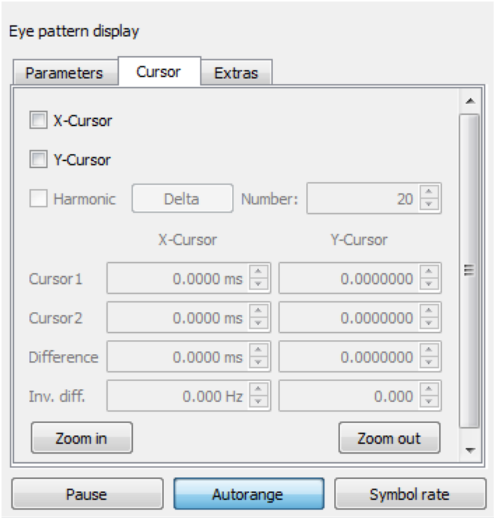


Figure 68 Eye Pattern Display Cursor Tab

The following parameters are available:

Parameter	Function
☑ **X-Cursor**	The cursors are activated/deactivated in X-direction. They are used to measure values of time.
☑ **Y-Cursors**	The cursors are activated/deactivated in Y-direction. They are used to measure the values on the Y-axis (which vary from display to display, i.e. phase, frequency, etc.).
☑ **Harmonic**	Several cursors are activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor. The Harmonic function can only be applied in combination with X-cursors, Y-cursors or Z-cursors. It serves to measure repeating intervals.
<Delta>	This button serves to insert a specific number of numbered cursors (Number – 2) at equidistant intervals in the area delimited by Cursor1 and Cursor2. Once selected, the button is disabled and the checkbox ☑ Harmonic is ticked. This feature allows for convenient activation of the Harmonic function for specific areas without the need to adapt the cursors. To cancel the additional cursors, deactivate the checkbox ☑ Harmonic. When doing so, please note that Cursor2 will take the position of the first additional cursor.
Number	Use this spin box to determine the number of cursors to be displayed in Harmonic mode.
Cursor1	Coordinates of the first X-, Y- and Z-cursor each
Cursor2	Coordinates of the second X-, Y- and Z-cursor each
Difference	Difference between Cursor1 and Cursor2
Inv. Diff.	Inverted difference is a helpful function for direct readout of symbol rate (determination of which is a major purpose of the Z-cursors) according to the formula 1 / [value in box Difference]
<Zoom in>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Zoom out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude, frequency or phase range. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, the process will be deactivated (toggle).

Parameter	Function
Symbol Rate	Switch the display of the symbol rate pins in the eye pattern display on and off (toggle function) by use of this parameter.

Table 41: Eye Pattern Display Cursor Parameters

Extras

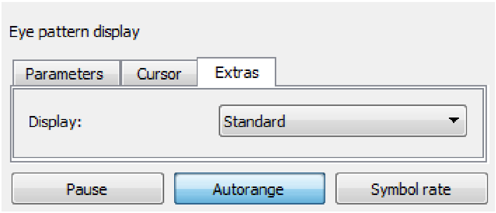


Figure 69 Eye Pattern Display Extras Tab

The <*Extras*> tab features additional options with regard to the display type. The list box Display serves to select the color schemes for the displays:

Color Scheme	Foreground Color	Background Color
Standard	light	black
Inverse	dark	white
Monochrome	shades of grey	white

Table 42: Eye Pattern Display Color Schemes

In the spectrum/sonagram display, the tab <*Extras*> features a checkbox ☑ *Audio output freq.*

Analysis Display

In contrast to the other display types, the operation of the analysis display does not depend on the availability of a demodulator. It filters a signal from a signal band (parameters *Filter Centre* and *Filter Bandwidth)* and displays the curves of the three most important characteristics, i.e. amplitude (magnitude), phase and frequency, in the specified period of time. Depending on the modulation type, there are characteristic signal curves.

go2DECODE

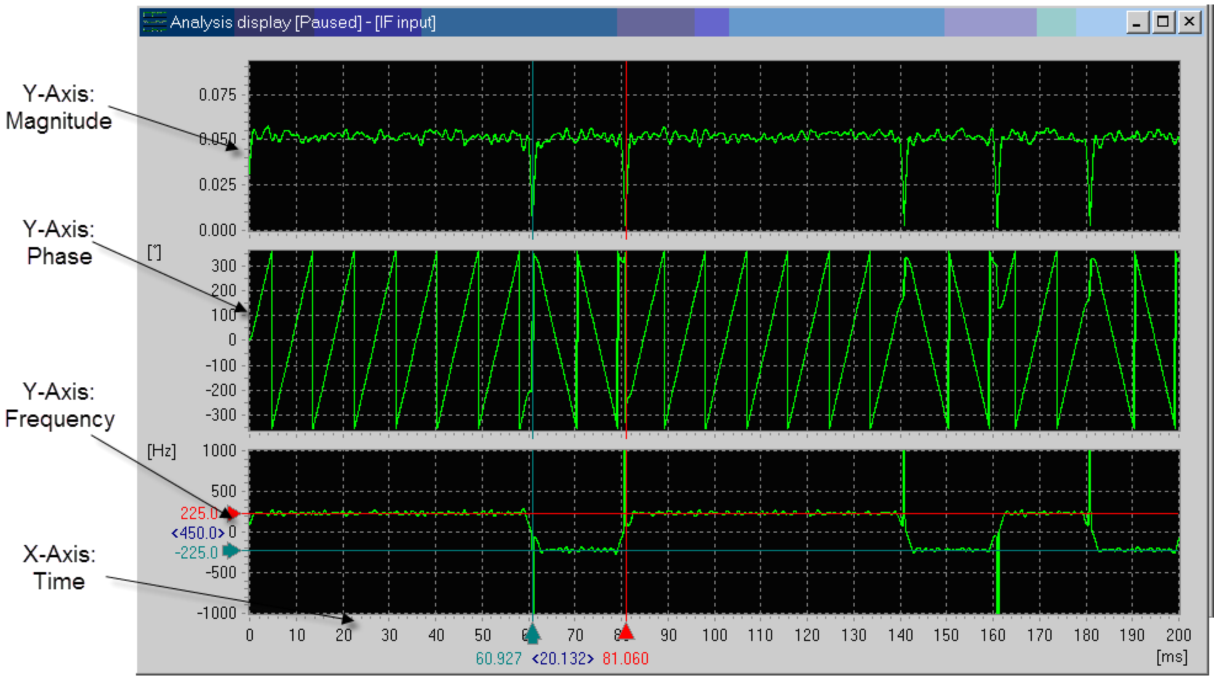


Figure 70 Analysis Display

This display is divided into three parts:

The upper part displays the curve of the magnitude (amplitude) of the signal.

The central part displays the phase of the signal.

The lower part displays the frequency of the signal.

The analysis display shows the time on the X-axis. Time 0 is the start of the signal section.

Parameter Setting

The parameters of the analysis display are shown on the tab <*Parameters*>.

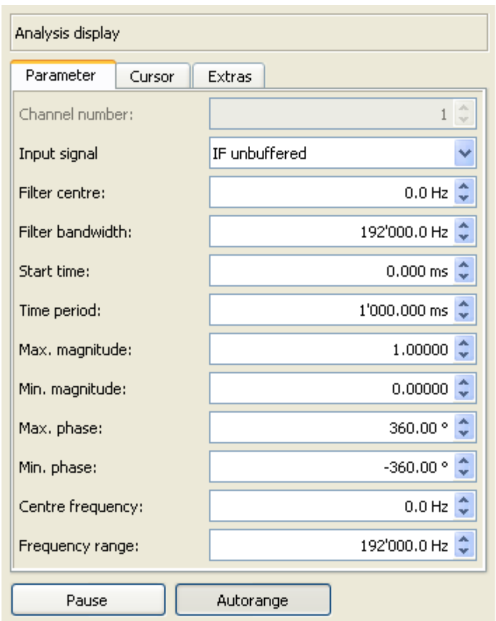


Figure 71 Analysis Display Parameter Tab

The following parameters are available:

Parameter	Function
Channel number	There are signals which consist of several signal parts, e.g. the input signal Channel in an MFSK2 modem. By using the channel number the channels of such signals can be selected as the input signal.
Input signal	Use this parameter to select the input signal of the display. If the automatic production is active, you can only select IF input.
Filter centre	Definition of the centre frequency of the filter. The filter range, i.e. the signal section to be ana-lyzed, is set in combination with the filter bandwidth.
Filter bandwidth	Definition of the bandwidth of the filter. The filter range, i.e. the signal section to be analyzed, is set in combination with the filter centre.
Start time	The period of time to be viewed is set in combination with the time period.
Time period	The period of time to be viewed is set in combination with the start time. A zoom thus can be set manually.
Max. magnitude	Definition of the magnitude range of the analysis display. The maximum magnitude is the upper end of the section.
Min. magnitude	Definition of the magnitude range of the analysis display. The minimum magnitude is the lower end of the section.
Max. phase	Definition of the phase range of the analysis display. The maximum phase is the upper end of the section.
Min. phase	Definition of the phase range of the analysis display. The minimum phase is the lower end of the section.
Centre frequency	The centre frequency is the centre of the section.
Frequency range	The frequency range is the range within the section. The zoom can thus be set manually.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude, frequency and phase range. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).

Table 43: Analysis Display Parameter Parameters

Cursor Tab

The <*Cursor*> tab of the Analysis Display provides separate checkboxes and spin boxes to activate and adjust the Y-cursors in the magnitude, phase, and frequency plots (☑ *Y: Magnitude,* ☑ *Y:Phase* and ☑ *Y:Frequency)* along with a checkbox for X-cursors through all plots (☑ X:Time).

The cursor parameters are displayed by activating the <*Cursor*> tab of the respective display. You can thus insert cursors into the display, which serve to select or clarify specific display sections, or measure the signal data. The <*Cursor*> tab shows the coordinates of the individual cursor positions in editable spin boxes.

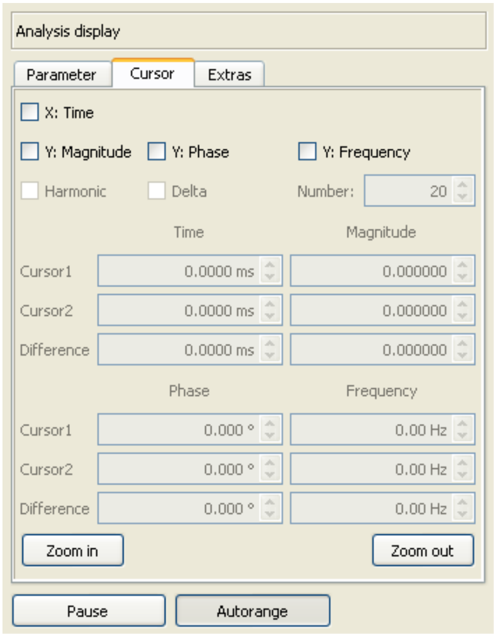


Figure 72 Analysis Display Cursor Tab

Parameter	Function
☑ X-Time	The cursors are activated/deactivated in X-direction. They are used to measure values of time.
☑ Y-Magnitude	The cursors are activated/deactivated in Y-direction. They are used to measure the values on the Y-axis (which varies from display to display, i.e. magnitude, phase, frequency, etc.).
☑ Y-Phase	The cursors are activated in Y-direction. They are used to measure the phase
☑ Y-Frequency	The cursors are activated/deactivated in Y-direction. They are used to measure the values of frequency on the Y-axis (.which varies from display to display, i.e. magnitude, phase, frequency, etc.).
☑ Harmonic	Several cursors are activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor. The Harmonic function can only be applied in combination with X-cursors, Y-cursors or Z-cursors. It serves to measure repeating intervals.
☑ Delta	This button serves to insert a specific number of numbered cursors (Number – 2) at equidistant intervals in the area delimited by Cursor1 and Cursor2. Once selected, the button is disabled and the checkbox ☑ Harmonic is ticked. This feature allows for convenient activation of the Harmonic function for specific areas without the need to adapt the cursors. To cancel the additional cursors, deactivate the checkbox ☑ Harmonic. Doing so, please note that Cursor2 will take the position of the first additional cursor.
Number	Use this spin box to determine the number of cursors to be displayed in Harmonic mode.
Cursor1	Coordinates of the first X-, Y- cursor each
Cursor2	Coordinates of the second X-, Y- cursor each
Difference	Difference between Cursor1 and Cursor2
Cursor1	Coordinates of the first X-, Y- cursor each
Cursor2	Coordinates of the second X-, Y- cursor each
Difference	Difference between Cursor1 and Cursor2
<Zoom in>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted

Parameter	Function
	line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Zoom out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total amplitude, frequency and phase range. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).

Table 44: Analysis Display Cursor Parameters

Extras

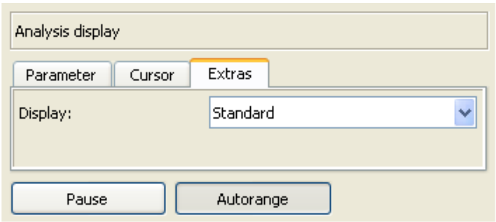


Figure 73 Analysis Display Extras Tab

The <*Extras*> tab features additional options with regard to the display type. The list box Display serves to select the color schemes for the displays:

Color Scheme	Foreground Color	Background Color
Standard	light	black
Inverse	dark	white
Monochrome	shades of grey	white

Table 45: Analysis Display Color Schemes

Constellation Display

The constellation display shows the signal in the complex plane of numbers as a real part (in phase) and an imaginary element (quadrature). Several signal sections can be displayed in a superimposed display.

The display can be operated in the modes *absolute* or *difference phase*. These two display types can be displayed in synchronization with the symbol rate which is recovered by the demodulator.

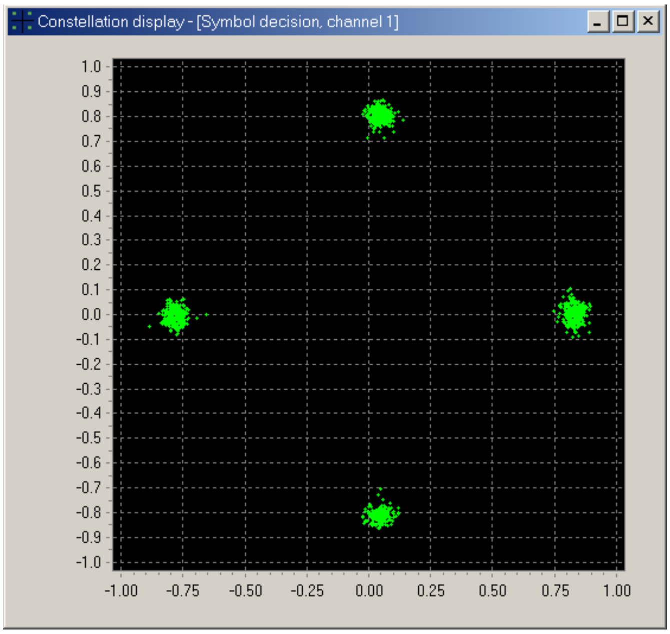


Figure 74 Constellation Display

For the real part, an X-axis is drawn in the display. The imaginary element is drawn on the Y-axis.

In mode *difference phase*, the difference between the phase of the current value and the phase of the previous value is displayed. This eliminates the potential rotation of the signal vector.

In mode *absolute SR* or d*ifference phase SR*, only the values used for symbol decision will be displayed. This way, signal transitions will be deleted. In a correct demodulation (for example PSK4, QAM), the phase star of the current demodulation will be displayed.

Parameter Setting

The parameters of the constellation display can be displayed by activating the tab <*Parameters*>.

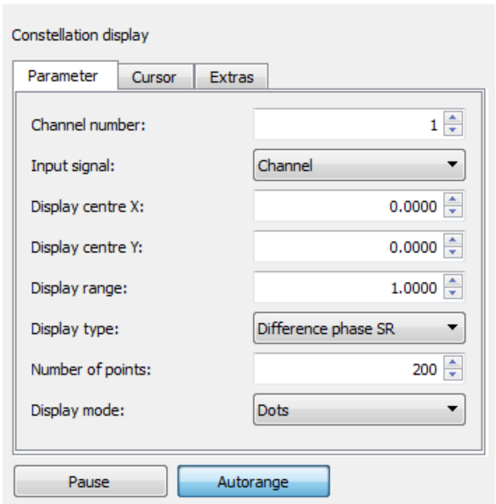


Figure 75 Constellation Display Parameter Tab

The following parameters are available:

Parameter	Function
Channel number	There are signals which consist of several signal parts, e.g. the input signal Channel in an MFSK2 modem. By using the channel number the channels of such signals can be selected as the input signal.

Parameter	Function
Input signal	Use this parameter to select the input signal of the display. If the automatic production is active, you can only select IF input. While setting the parameters of the demodulator, it may occur that a previously selected input signal is no longer available. In this case, the item no signal will be displayed.
Display centre X	Definition of the centre of the display in X-direction. The display range of the real part is set in combination with the Display range.
Display centre Y	Definition of the centre of the display in Y-direction. The display of the imaginary element is set in combination with the Display range.
Display range	Definition of the range of the display in X-direction and Y-direction. The display range of the real part is set in combination with Display centre X, and the display range of the imaginary element is set in combination with Display centre Y. The zoom can thus be set manually.
Display type	Use this parameter to set the type of the display: Absolute: Display of the complex signal Absolute SR: Display of the complex signal only at the symbol rate time Difference phase: As Absolute, but phase as difference Difference phase SR: As Absolute but phase as difference and only at the symbol rate time
Number of points	Sets the number of signals drawn in superimposed display.
Display mode	Use this parameter to set the display mode of the display: Dots: Every value in the complex plane of numbers is displayed as a point. Lines: The individual values are linked and are displayed as a continuous row.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total real and imaginary part. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).

Table 46: Constellation Display Parameter Parameters

Cursor Tab

The cursor parameters are displayed by activating the <*Cursor*> tab of the respective display. You can thus insert cursors into the display, which serve to select or clarify specific display sections, or measure the signal data. The <*Cursor*> tab shows the coordinates of the individual cursor positions in editable spin boxes.

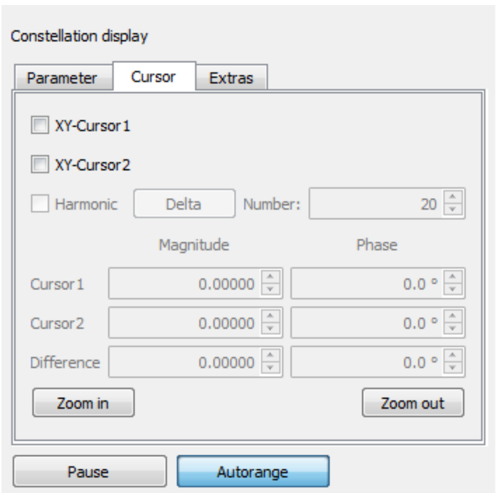


Figure 76 Constellation Display Cursor Tab

Parameter	Function
☑ XY-Cursor 1	The cursors are activated/deactivated in XY-direction. They are used to display the current value in difference of phase.
☑ XY-Cursors 2	The cursors are activated/deactivated in XY-direction. They are used to measure the previous value. in difference of phase.
☑ Harmonic	Several cursors are activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor. The Harmonic function can only be applied in combination with X-cursors, Y-cursors or Z-cursors. It serves to measure repeating intervals.
<Delta>	This button serves to insert a specific number of numbered cursors (Number – 2) at equidistant intervals in the area delimited by Cursor1 and Cursor2. Once selected, the button is disabled and the checkbox ☑ Harmonic is ticked. This feature allows for convenient activation of the Harmonic function for specific areas without the need to adapt the cursors. To cancel the additional cursors, deactivate the checkbox ☑ Harmonic. Doing so, please note that Cursor2 will take the position of the first additional cursor.
Number	Use this spin box to determine the number of cursors to be displayed in Harmonic mode.
Cursor1	Coordinates of the first X-, Y- and Z-cursor each
Cursor2	Coordinates of the second X-, Y- and Z-cursor each
Difference	Difference between Cursor1 and Cursor2
<Zoom in>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Zoom out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total real and imaginary part. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).

Table 47: Constellation Display Cursor Parameters

Extras

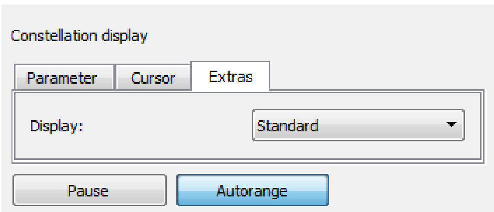


Figure 77 Constellation Display Extras Tab

The <*Extras*> tab features additional options with regard to the display type. The list box Display serves to select the color schemes for the displays:

Color Scheme	Foreground Color	Background Color
Standard	light	black
Inverse	dark	white
Monochrome	shades of grey	white

Table 48: Constellation Display Color Schemes

Hell Display

The Hell display shows the variation of the signal in time in scales of gray. The scales of gray are produced by evaluation of the individual samples of the signal.

Figure 78 Hell Display

An X-axis is drawn in the Hell display for the periods of a row. The values of time are drawn on the Z-axis.

The Hell display provides an overview of bit patterns in the signal and allows for the analysis of bit lengths and the definition of the circulation times of specific signals. The values of time of the bits can be measured by using the cursors.

Parameter Setting

The parameters of the Hell display can be displayed by activating the tab <*Parameters*>.

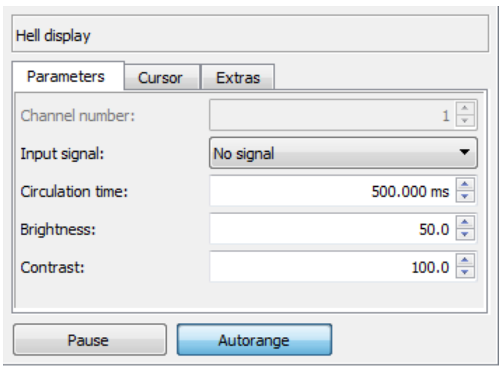


Figure 79 Hell Display Parameters Tab

The following parameters are available:

Parameter	Function
Channel number	There are signals which consist of several signal parts, e.g. the input signal Channel in an MFSK2 modem. By using the channel number the channels of such signals can be selected as the input signal.
Input signal	Use this parameter to select the input signal of the display. If the automatic production is active, you can only select the input IF. While setting the parameters of the demodulator, it may occur that a previously selected input signal is no longer available. In this case, the selection no signal will be displayed.
Circulation time	Defines the time required to draw a row. By using this parameter you can set the skew of a symbol pattern in that way, that the frames are positioned vertically.. The display range of the pattern can be doubled or halved by doubling or halving the circulation time. If the skew is positioned vertically, the symbol rate can be defined: 1000 / duration of one column of the frame (to be measured using X-cursors and ☑ Harmonic).
Brightness	Sets the brightness of the display. The lower the brightness, the darker the image. When the display type is inverted, the image becomes darker as the brightness increases.
Contrast	Sets the contrast of the display. The higher the contrast, the lower the number of shades of gray in the image. With a high contrast, the image has a high definition. With a low contrast, the image is dim.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view shades of gray. The mode Autorange analyzes approx. 12 rows. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).

Table 49: Hell Display Parameters Parameters

Cursor Tab

The cursor parameters are displayed by activating the *<Cursor>* tab of the respective display. You can thus insert cursors into the display, which serve to select or clarify specific display sections, or measure the signal data. The *<Cursor>* tab shows the coordinates of the individual cursor positions in editable spin boxes.

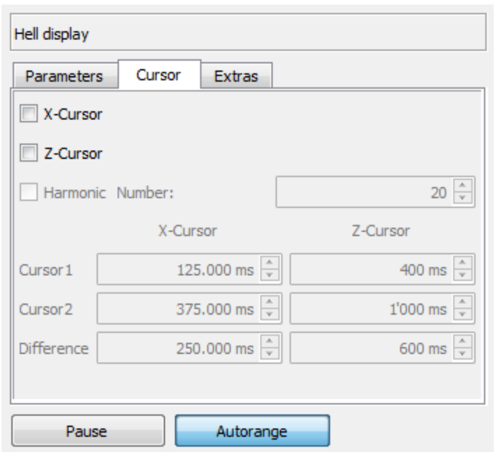


Figure 80 Hell Display Cursor Tab

Parameter	Function
☑ X-Cursor	The cursors are activated/deactivated in X-direction. They are used to measure periods of a row.
☑ Z-Cursor	The cursors are activated in Z-direction. They are used to measure values of time.
☑ Harmonic	Several cursors are activated at equidistant intervals. In this mode, the first cursor will move all other cursors. The intervals are defined by grabbing and moving the second or any following cursor. The Harmonic function can only be applied in combination with X-cursors, Y-cursors or Z-

Parameter	Function
	cursors. It serves to measure repeating intervals.
Number	Use this spin box to determine the number of cursors to be displayed in Harmonic mode.
Cursor1	Coordinates of the first X-, Y- and Z-cursor each
Cursor2	Coordinates of the second X-, Y- and Z-cursor each
<Zoom in>	With enabled cursors, the button <**Zoom In**> serves to graphically zoom into the area delimited by the cursors. With disabled cursors, the zoom enlarges the area by factor ½ each time it is activated (X-direction only). Additionally, the user may draw a rectangle in the display window and zoom into this section graphically by means of the button <**Zoom In**>. If the display window has activated cursors, the zoom via rectangle will take priority. After zooming, the rectangle shown as a white dotted line will disappear. Otherwise, simply click any position in the display window to delete the rectangle.
<Zoom out>	Each time the button <**Zoom Out**> is activated, the display area is enlarged by factor 2. With disabled cursors, the zoom is exclusively made in X-direction.
<Pause>	In Pause, the display is stopped (not the signal processing). Modification of the parameters is possible for a more detailed analysis of the current signal range.
<Autorange>	Automatic setting of the displayed range to view the total real and imaginary part. The mode Autorange analyzes approx. 12 vectors. The display is adapted on every change of the range. On pressing <**Autorange**> again, this process will be deactivated (toggle).

Table 50: Hell Display Cursor Parameters

Extras

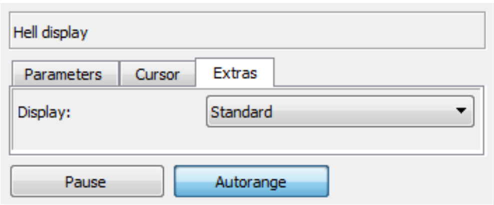


Figure 81 Hell Display Extras Tab

The <*Extras*> tab features additional options with regard to the display type. The list box Display serves to select the color schemes for the displays:

Color Scheme	Foreground Color	Background Color
Standard	light	black
Inverse	dark	white
Monochrome	shades of grey	white

Table 51: Hell Display Color Schemes

Bit Display

Symbols are the output of a demodulation process. Every symbol can be viewed as a sequence of bits. The bit display shows symbols or bits.

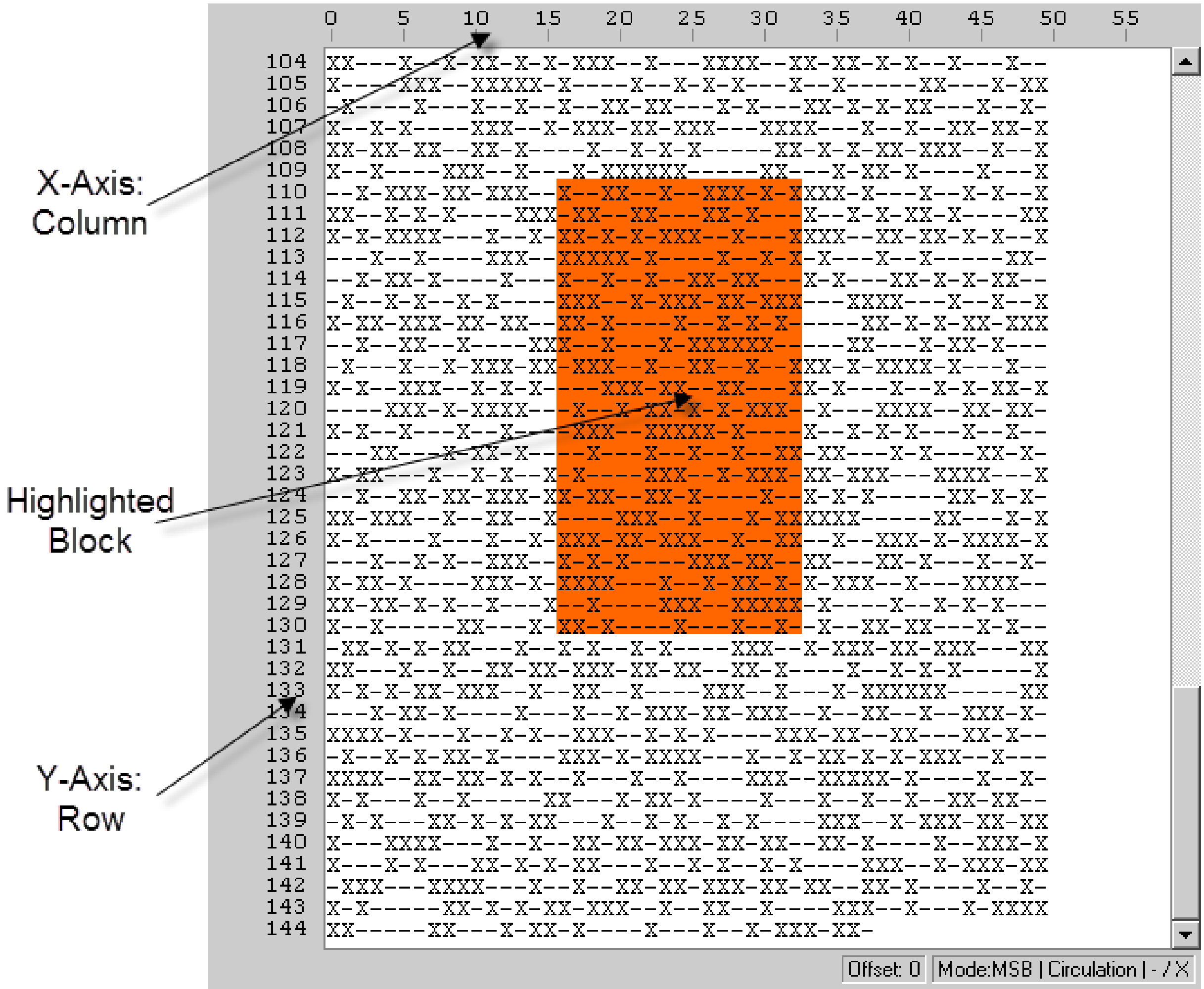


Figure 82 Bit Display

Column numbers for the bits or symbols are drawn on the X-axis. The row numbers are drawn on the Y-axis.

The bit display presents an overview of sequences of symbols and serves to analyze repeating bit patterns. Parts of the bit patterns can be highlighted. The highlighted part of the bit pattern or all bits saved in the bit display can be saved in a file.

Parameter Setting

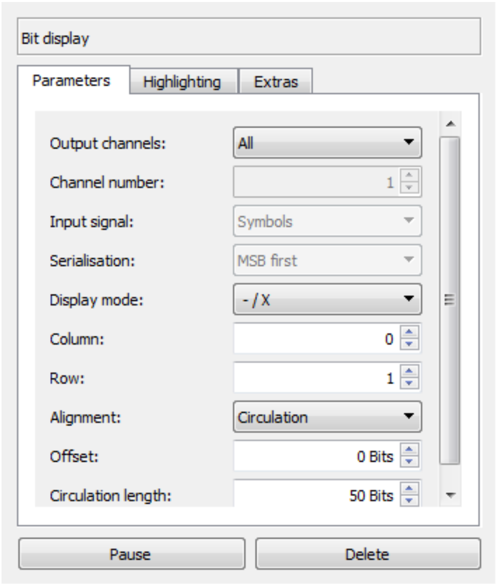


Figure 83 Bit Display Parameters Tab

Parameter	Function
Output channels	One symbol may consist of several channels, e.g. in an MFSK2 modem. This parameter serves to set the channels to be displayed: All: All channels of the symbol are displayed. Channel number: Symbols of a specified channel are displayed.
Channel number	Sets the channel of the symbols displayed. In a modem with one channel, there is only channel number 1.
Input signal	Use this parameter to select the input signal of the display. If the Automat is on, the option No signal will be displayed since the bit display does not support any IF input signal.
Serialisation	This parameter serves to set the dissection mode of the symbols to bits: LSB first: The least significant bit, i.e. the bit with the least significance of the symbol, is displayed first. MSB first: The most significant bit, i.e. the bit with the highest significance of the symbol, is displayed first.
Display mode	Use this parameter to set the mode in which the bits are displayed. If bits are displayed, the character left to the slash "/" stands for bit 0, and right to the slash "/" for bit 1. – / X: Display the bits as"–" (value 0) and "X" (value 1) . / 1: Display the bits as "." (value 0) and "1" (value 1) White / Black: Display the bits white (value 0) and black (value 1) L / H: Display the bits as "L" (value 0) and "H" (value 1) Symbols / Channel: A symbol number for every channel is displayed in this display type (0: first channel, 1: second channel, etc.)
Column	Sets the number of the column in which the bit pattern is displayed. The column is in the left end of the section to be viewed.
Row	Sets the number of the row in which the bit pattern is displayed. The row is in the upper end of the section to be viewed. This parameter cannot be modified unless the display type has been suspended using <Stop> or <Pause>.
Alignment	This parameter serves to select the mode which defines the length of a row: Circulation: The parameter Circulation defines the length of a row. Burst: The duration of a burst (in symbols) defines the length of a row. The mode Burst length cannot be set unless there is a modem in which the burst mode has

Parameter	Function
	been activated.
Offset	Defines the number of the first bit from which the bit pattern is displayed.
Circulation length	Defines the number of bits required to draw a row. If the length is greater than the visible section, the invisible section can be displayed by means of the parameter Column. Columns which include only one bit number are called frames. Use this parameter to set the skew of the bit sequences to make the repeating bit patterns visible with frame. This parameter cannot be modified unless the row mode has been set to Circulation length.
<Pause>	The display is suspended in Pause and the parameters can be modified for a more detailed analysis of the bit pattern.
<Delete>	Deletes the display and all saved bits of the bit display.

Table 52: Bit Display Parameters Parameters

Highlight Function

The parameters of the highlight function can be displayed and modified by activating the tab *<Highlight-ing>* in enabled mode *Pause*.

Use the mouse for the highlighting operation:

- Move the mouse pointer to the start position of the block to be highlighted.
- Press the left mouse button.
- Drag the highlight to the end position of the block without releasing the left mouse button.
- After releasing the mouse button, the desired block has been defined.

Use the right mouse button to open a popup menu in the bit display. The popup menu serves to:

- Copy the highlighted block to the clipboard of the system.
- Save all symbols of the bit display to a file.
- Save the highlighted block to a file.

The individual items of the highlight option are displayed on the tab *<Mark>* and can be edited:

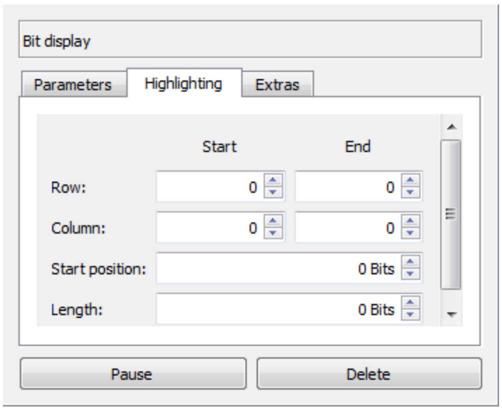


Figure 84 Bit Display Highlight Tab

Column: Defines the start and the end of the column of the highlighted block.

Row: Defines the start and the end of the row of the highlighted block.

Extras

The *<Extras>* tab serves to change the font size of the bit display and to include the bit display quality.

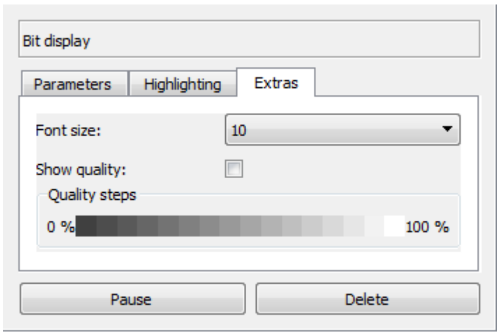


Figure 85 Bit Display Extras Tab

Parameter	Function
Font size	Defines the size of a bit in the display. With small font sizes, more bits will be visible than with large font sizes. Identification of details will be harder with small font sizes.
☑ Show quality	Highlights the quality of the individual bits in shades of gray. The lighter the color, the better the quality of the individual bit.

Table 53: Bit Display Extras Parameters

DANA (Digital Analogue Audio Interface)

DANA is an abbreviation for *Digital Analogue Audio Interface*. It converts analogue signals into complex IF signals and provides these complex signals as a TCP/IP server to the APC. Two signal sources are available:

Analogue signals from the sound card with a sampling rate of 48 kHz or 96 kHz (online), e.g. files generated and played using the signal generator SOMO, or wave files (playing mode *Sound*) played by means of any media player.

Wave and RAW files can also be read directly using DANA (offline, playing mode *File*). Make sure that the APC is ready (indicated by the green dot on the status bar) and note that, in contrast to other players, no audible sound output is available.

The input signal is converted into a digital intermediate frequency (IF). To add a filter, enter the center frequency and the bandwidth.

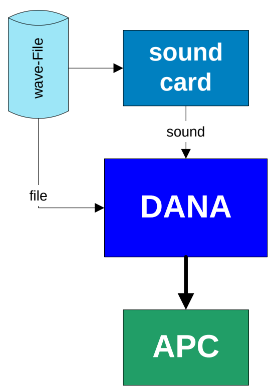


Figure 86 Functional DANA

The individual menus and windows of DANA are explained on the following pages. The appearance of the DANA screen depends on the selection of the setting *Sound* or *File*. In the setting *File*, a play list with the corresponding functions and parameters will be displayed in addition.

Start of DANA

Select **<Programs> <go2SIGNALS> <go2DECODE> <DANA>** in the WINDOWS 7 program group of the start menu to start DANA**.**

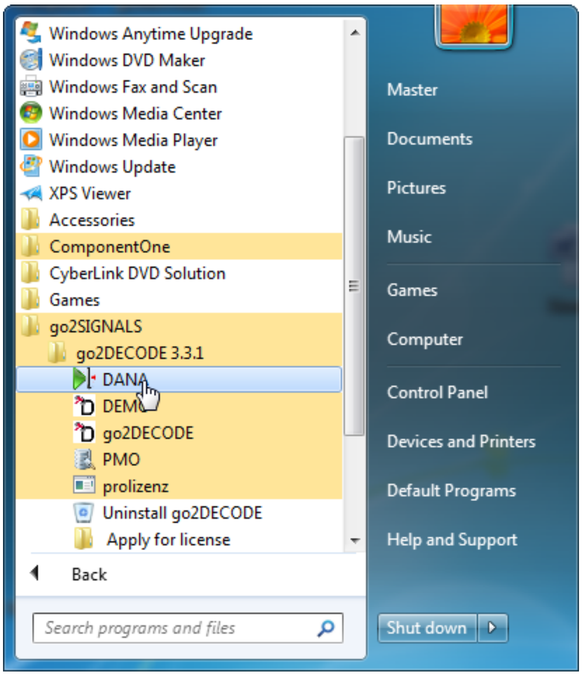


Figure 87 Start of DANA

Operation of DANA

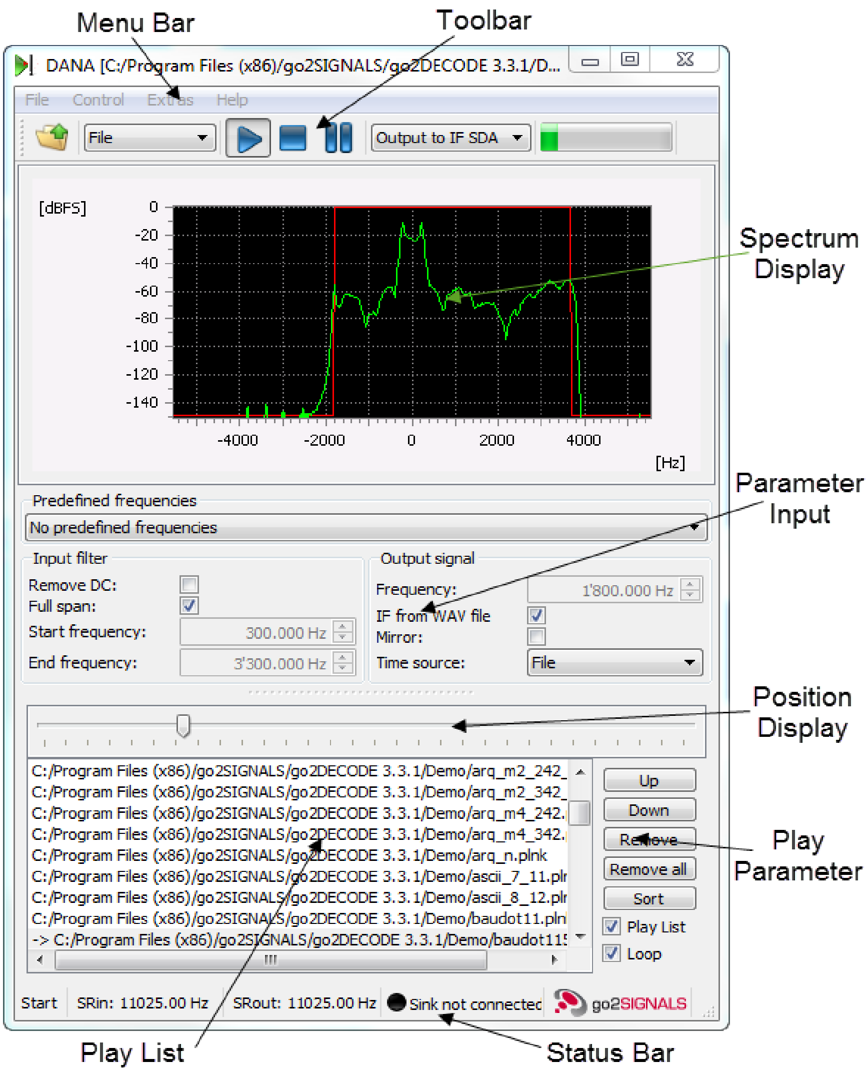


Figure 88 DANA User Interface

Control of DANA

Menu Bar

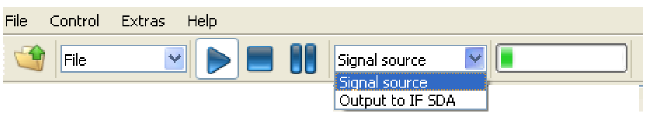


Figure 89 Menu Bar

File Menu

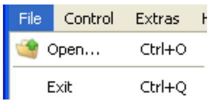


Figure 90 File Menu

Menu Item	Function
File	Open… Load selected .wav and .raw files into the play list (only displayed if the selected source is File). Simultaneous selection and loading of several files is possible) Exit Application is closed; the files in the play list will be stored.

Table 54: DANA File Menu Functions

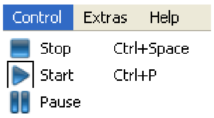


Figure 91 Control Menu

Menu Item	Function
Control	Stop Stop playback. SDA no longer receives any signal data. Start Start playback. SDA receives signal data. Pause With DANA in Start mode, playback will be halted; in Pause mode, playback will be restarted.

Table 55: DANA Control Menu Functions

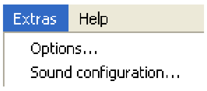


Figure 92 Menu Extras

Menu Item	Function
Extras	Options… The dialog window Options… controls the handling of files or signals, respectively. It consists of two group boxes: The checkbox ☑ flush in the group box Buffer Management serves to instruct DANA to send noise for a specific time after playing back a file with deactivated Loop function. This is done in order to empty the APC buffers. When the checkbox ☑ auto output rate in the group box Signal Processing is activated, DANA will choose the output sampling rate automatically, otherwise DANA will select a value close to the one specified in the spin box nominal output sample rate.

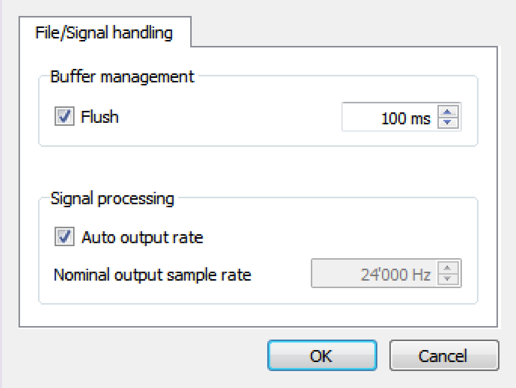
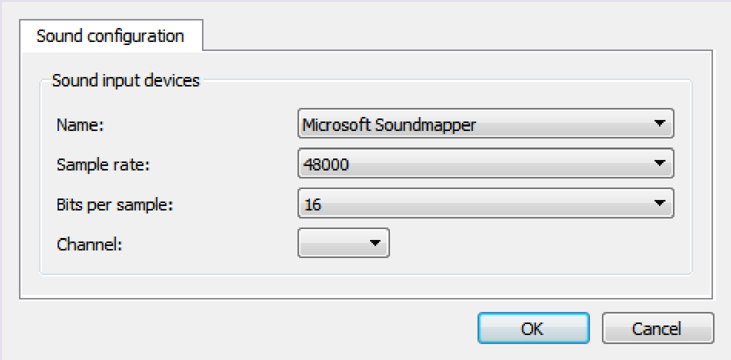
Menu Item	Function
	 Sound Configuration… If your system features various sound cards (e.g. with different numbers of channels), use this item to select and configure the existing sound input devices. Select the desired device in the displayed dialog box, enter the values for sample rate and bits per sample, and edit the number of channels. 

Table 56: DANA Extras Menu Function

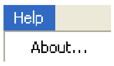


Figure 93 Menu Help

Menu Item	Function
Help	Select this item to display information about DANA (About…).

Table 57: DANA Help Menu Function

Toolbar

Figure 94 DANA Toolbar

Icon	Function
	Load .wav or .raw file
	Signal source: Sound: The signal is received from the current recording source of the system with 48000 Hz. The *.wav* file can be played by using e.g. Windows® Media Player

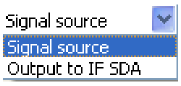
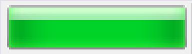
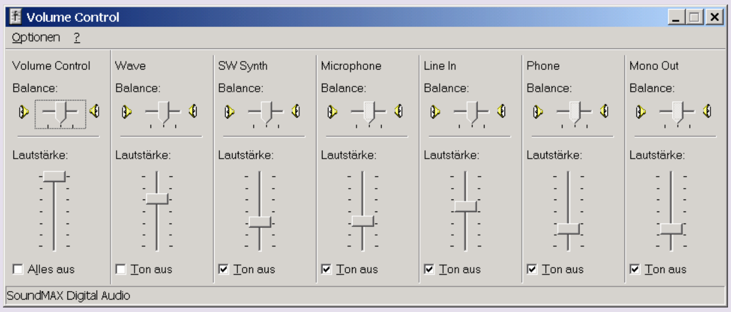
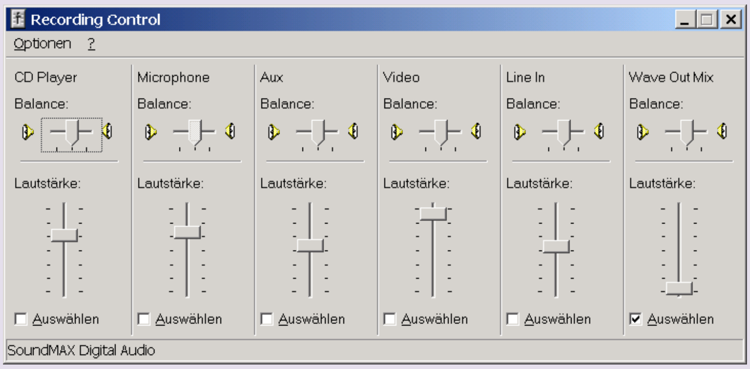
Icon	Function
	File: The *.wav* or *.raw* file is played directly via DANA. This is not possible unless the APC is ready (indicated by the green dot on the status bar).
	Stop
	Start
	Pause
	Selection of spectrum display: Signal source: Spectrum display of the input signal Output to IF SDA: Spectrum display of the output signal
 	Gain display of input signal: Green: O.K. / Red: Over modulated If the gain display is red and the source Sound is selected, adjust the Windows® volume control: Start - Programs - Accessories - Entertainment Media - Volume Control  Select the item Properties in the Options menu. Set the volume by selecting ⦿ Recording and activating the checkbox ☑ Wave Out Mix. In case your specific sound card does not provide this item, select either Wave or "What you hear". If none of these items is available, connect the Line out socket of your computer to the Line in socket via cable.  Slide down the volume control until the gain display turns green.

Table 58: DANA Toolbar Icons

Spectrum Display

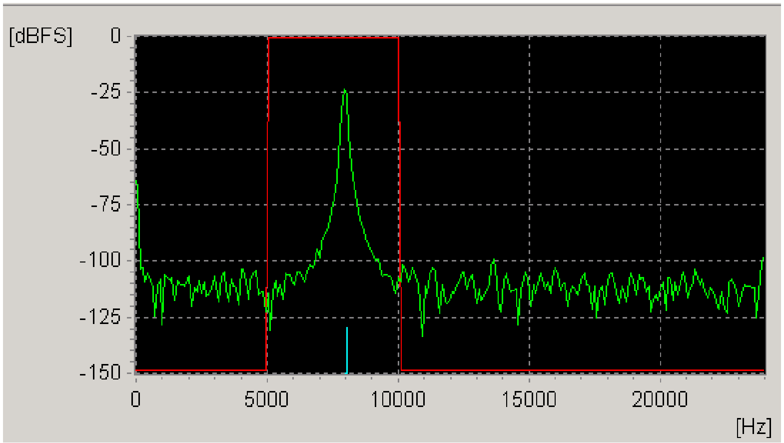


Figure 95 Input Signal with Filter Range 5 –10 kHz

In this window, the spectrum (green) of the input signal or output signal (in dBFS) is displayed above the frequency axis (in Hz). Additionally, the filter range for the signal (red) is displayed. The blue line indicates the selected centre frequency for the IF of the input signal.

The figure above shows an example of an input signal with a filter range from 5 kHz to 10 kHz. The corresponding output signal with a selected frequency of 8 kHz (in this case equal to the signal position in the input signal) then looks as follows:

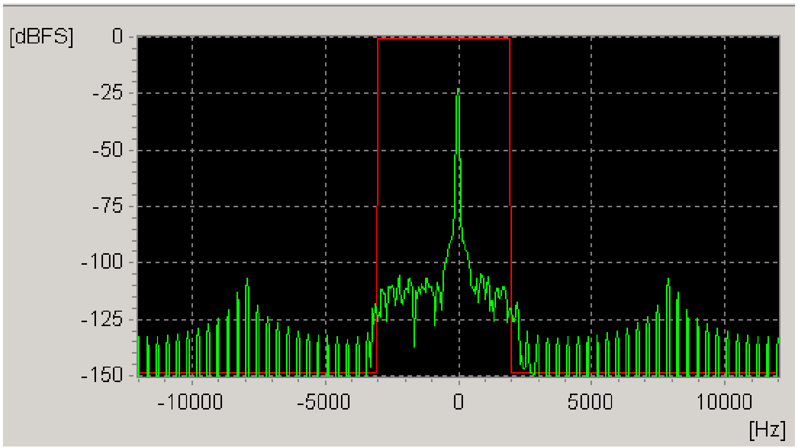


Figure 96 Output Signal with Filter Range and IF Center Frequency 8 kHz

Conversion Parameter Setting

There are three parameter suites for conversion and output, which are described below.

Predefined filter settings can be selected in the group box *Predefined Frequencies* for fast adaptation of the signal input to different receivers.

Predefined Frequencies

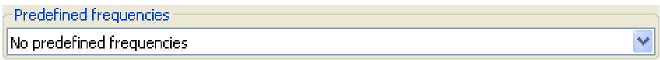


Figure 97 DANA Predefined Frequencies

Option	Description
No Predefined Frequencies	No predefined band pass filters or centre frequencies are used. The filter limits (Start Frequency, End Frequency) as well as the IF (Frequency) can be entered by the user.
SOMO default signal 20 kHz with 12.5 kHz IF	Filter limits from 2.5 kHz to 22.5 kHz, IF centered at 12.5 kHz (= default centre frequency in SOMO)
full span with 1.8 kHz IF	IF centered at 1800 Hz, no filter limits
base band 3 kHz with 1.8 kHz IF	Filter limits from 300 Hz to 3300 Hz, IF centered at 1800 Hz
20 kHz signal with 12.5 kHz IF	Filter limits from 2.5 kHz to 22.5 kHz, IF centered at 12.5 kHz

Table 59: DANA Conversion Parameter Options

In the configuration file *dana.conf* you can define your own predefined filter settings.

On every start this file will be read. Subsequently you can select the filter in the group field predefined frequencies.

The next figure shows an example of two predefined frequencies.

- Standard IF of a SOMO signal with full bandwidth
- IF of 1,8 kHz with full bandwidth

used to play the following example:

```
<?xml version="1.0" encoding="utf-8" ?>

<configuration>

  <appSettings>
    <add key="NumPreDefines"         value="2"       /> <!-- default = 0 -->
    <add key="Warn_FileDoesNotExist"  value="1"       /> <!-- default = 1 -->

    <add key="LogDirectory"          value="log"     /> <!-- default = "log" relative to
application -->
    <add key="LogLevel"              value="1"       />
    <add key="LogProtocol"           value="0"       />
    <add key="LogPerRun"             value="0"       />
    <add key="LogPerID"              value="0"       />
    <add key="LogMaxFileSize"        value="2"       />
    <add key="LogMaxFileNumber"      value="5"       />

    <add key="UseGUI"                value="1"       /> <!-- default = 1 -->

  </appSettings>

  <PreDef_1>
    <add key="Description"           value="1,8 kHz IF" />
    <add key="IF-Frequency"          value="1800"      />
  </PreDef_1>

  <PreDef_2>
    <add key="Description"           value="12,5 kHz IF" />
    <add key="IF-Frequency"          value="12500"     />
  </PreDef_2>
```

Figure 98 Example of a Configuration

The parameters for the input signal can be set in the group box *Input Filter:*

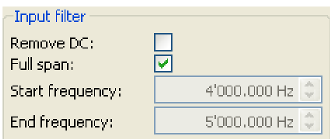


Figure 99 Input Filter

Input Filter

Parameter	Description
Remove DC	Removes the DC offset of the input signal. This option is particularly relevant for signals from the sound card.
Full Span	This option deactivates the band pass filter. The input signal is not filtered.
Start frequency	Defines the left limit frequency for the band pass filter. The value displayed refers to the input signal.
End frequency	Defines the right limit frequency for the band pass filter. The value displayed refers to the in-put signal.

Table 60: DANA Input Filter Parameters

No entries can be made in the boxes *Full Span*, *Startfrequency*, *Endfrequency* and *Frequency* unless *No Predefined Frequencies* has been selected.

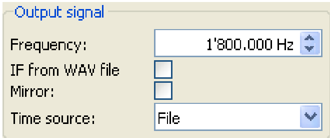


Figure 100 Output Signal

Output Signal

Parameter	Description
Frequency	The frequency entered defines the frequency position in the input signal which is shifted to zero in the output signal.
IF from WAV file	Selection of IF from the Audio file
Mirror	If signals are in flipped position (LSB, USB), the mirror mode can be activated to turn these sig-nals to normal position.
Time source	Defines the time for the IF signal (only in the mode File): File The time of the latest modification date of the wave or raw file is used. System clock The system clock of the computer is used. If Play List is activated, all files will be processed as files belonging to one signal.

Table 61: DANA Output Filter Parameters

Play List

On selecting the source *File* in the toolbar, DANA will display a play list of loaded files. Files cannot be played unless the APC is ready. The APC status is indicated in the status bar:

- green dot ● = Sink connected;
- black dot ● = Sink not connected.

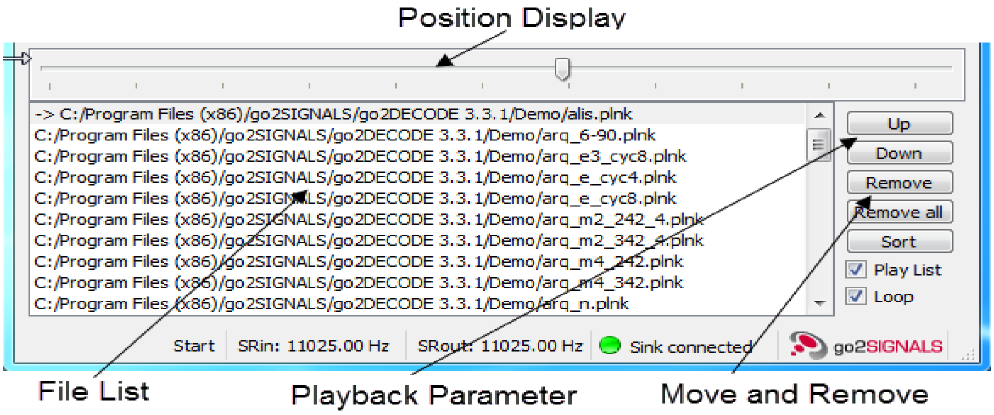


Figure 101 DANA Play List

Add and Remove Files

Files are loaded using the menu item *File – Open* or via the toolbar by clicking the icon . In either case, a dialog box will open:

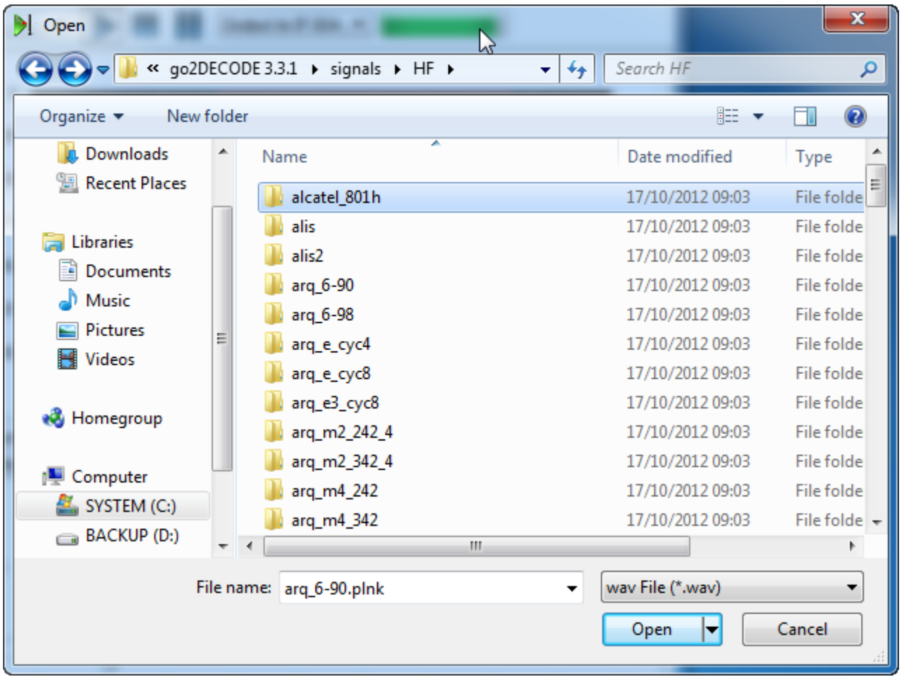


Figure 102 Add or Remove Files

In this dialog window, first select the file type and then one or several files. New files are added to the existing *Play List*.

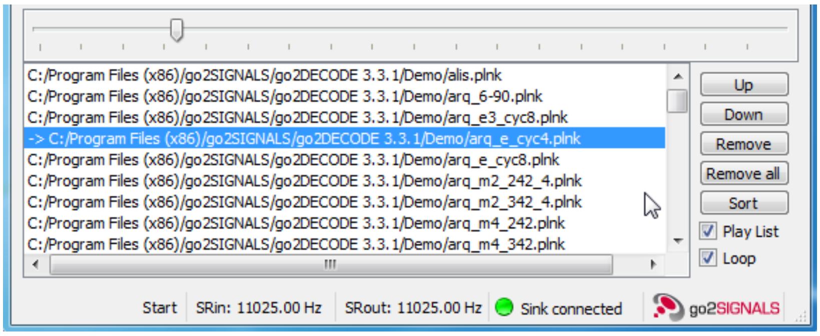


Figure 103 DANA Play List

Files highlighted via single mouse click can be moved or removed using the buttons to the right of the *Play List*:

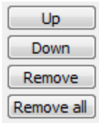


Figure 104 DANA Move List

Parameter	Description
<Up>	Move selected file upward by one position
<Down>	Move selected file downward by one position
<Remove>	Remove the selected file
<Remove all>	Remove all files in the list

Table 62: DANA Play List Parameters

Play Files

Start playback either via double clicking the desired file in the list or by activating the <**Start**> button ▶. The various play modes are selected by checking the checkboxes ☑ *Play List* and/or ☑ *Loop:*

Figure 105 DANA Playback List

Play List	Loop	Description
☐	☐	The file marked "->" is played once
☐	☑	The file marked "->" is played repeatedly
☑	☐	The list is played once from the file marked "->" to the last item in the list
☑	☑	The entire list is played repeatedly from the file marked "->"

If no file is marked "->", the first file in the list will be played when starting the playback. The progress display shows how much of the currently active file has been played.

Status Bar

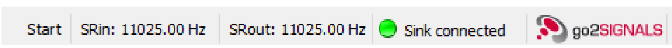


Figure 106 DANA Status Bar

Panel	Content
Status Field	Application status: Start, Stop or Pause

Panel	Content
SRin	Input sampling rate
SRout	Output sampling rate
APC Status	● = Sink connected; ● = Sink not connected
Company Logo	go2SIGNALS

Table 63: DANA Status Bar Panels

PMO (Production Memory Observer)

PMO *(Production Memory Observer)* is a tool to manage the production of the APC. It displays all production results as well as AF and IF recordings. The PMO interface displays the results and recordings in a clear structure and enables the user to select the specific date of the production of interest in order to view the desired recordings.

Start of PMO

Select **<Programs> <go2SIGNALS> <go2DECODE> <PMO>** in the WINDOWS 7 program group of the start menu to start PMO**.**

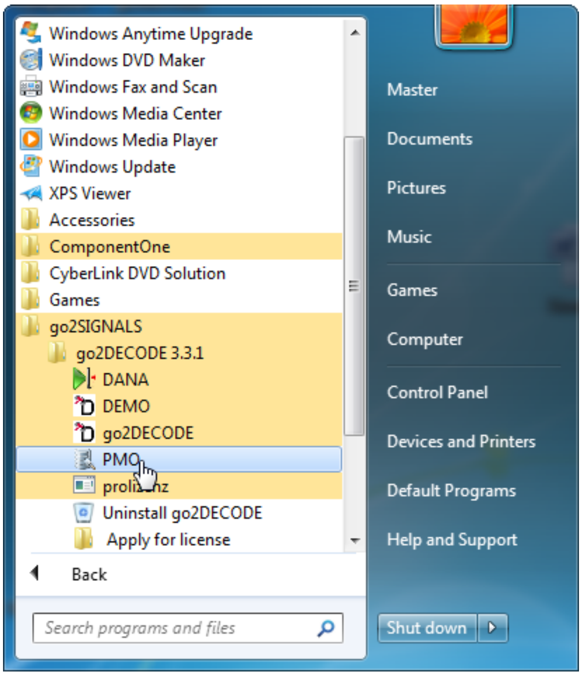


Figure 107 PMO Start

Operation of PMO

Initial Configuration

After the installation of the PMO the configuration file *pmo.conf* is filled.

Here you can specify the information processing of go2DECODE:

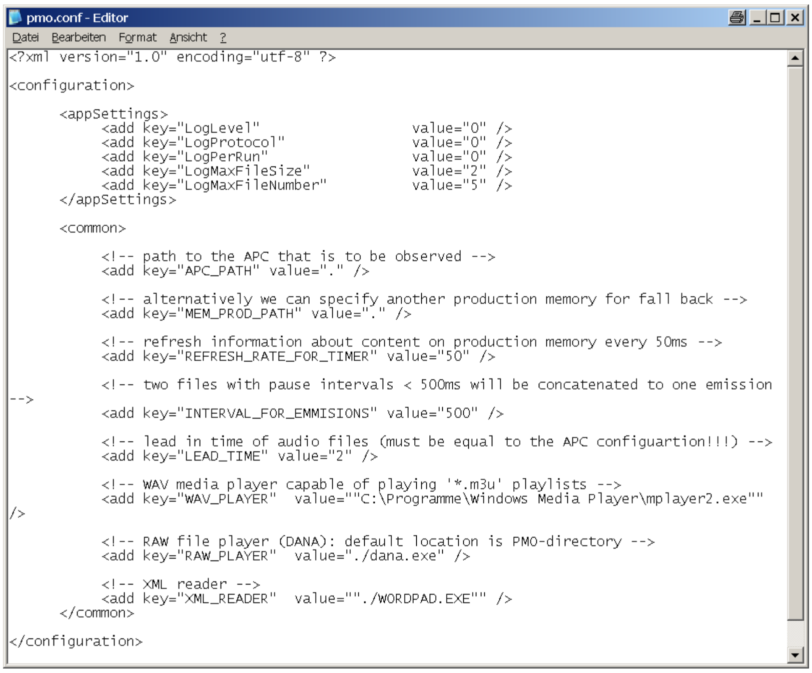
- playing recorded LF-records (Standard *Windows® Media Player)* or
- displaying production results(Standard *MS Wordpad*).

IF-files have to be played via DANA.

If you want to use a hex-reader of your own choice, you have to modify the configuration file accordingly.

At the first start of PMO the configuration file is copied from the application-directory to the user-directory User/Name/go2SIGNALS/go2DECODE.

Any change can be accomplished there.




```
<?xml version="1.0" encoding="utf-8" ?>

<configuration>

      <appSettings>
            <add key="LogLevel"                 value="0" />
            <add key="LogProtocol"              value="0" />
            <add key="LogPerRun"                value="0" />
            <add key="LogMaxFileSize"           value="2" />
            <add key="LogMaxFileNumber"         value="5" />
      </appSettings>

      <common>

            <!-- path to the APC that is to be observed -->
            <add key="APC_PATH" value="." />

            <!-- alternatively we can specify another production memory for fall back -->
            <add key="MEM_PROD_PATH" value="." />

            <!-- refresh information about content on production memory every 50ms -->
            <add key="REFRESH_RATE_FOR_TIMER" value="50" />

            <!-- two files with pause intervals < 500ms will be concatenated to one emission
-->
            <add key="INTERVAL_FOR_EMMISIONS" value="500" />

            <!-- lead in time of audio files (must be equal to the APC configuartion!!!) -->
            <add key="LEAD_TIME" value="2" />

            <!-- WAV media player capable of playing '*.m3u' playlists -->
            <add key="WAV_PLAYER"  value=""C:\Programme\Windows Media Player\mplayer2.exe""
/>

            <!-- RAW file player (DANA): default location is PMO-directory -->
            <add key="RAW_PLAYER"  value="./dana.exe" />

            <!-- XML reader -->
            <add key="XML_READER"  value=""./WORDPAD.EXE"" />
      </common>

</configuration>
```

Figure 108 Initial Configuration

Features of PMO

Start go2DECODE by clicking the executable file *pmo.exe* in the respective program directory, or click the link on your desktop, if any. Please note that if DANA is not running yet, it will be started along with PMO. The following dialog window is displayed:

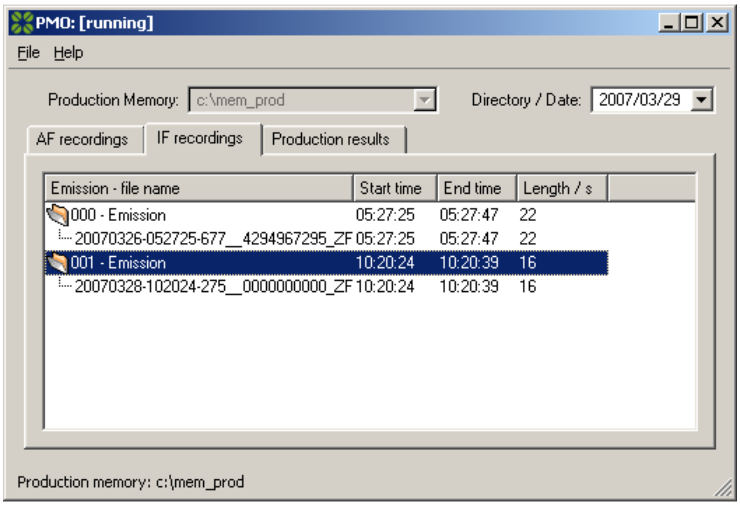


Figure 109 PMO User Interface

Select the desired date in the drop-down list box *Directory / Date* on the top right. The production results and recordings for this date are then shown in a tree structure on the three tabs <*AF recordings*>, <*IF recordings*>, and <*Production results*>. All files belonging to the same emission are stored in one folder. The recording time limit is configurable (APC configuration file *apc.conf*) and the folders *XXX - Emission* may therefore contain several files.

The tab <*AF recordings*> shows the audio files (*.*wav* files) of the emission. These files are played back using the media player specified in the PMO configuration file.

The tab <*IF recordings*> shows the *.raw* files which are subsequently played by DANA.

The tab <*Production results*> features the results in *.txt* format. These files are displayed in the text editor specified in the PMO configuration file.

Finally, the tab <*Binary results*> features the binary output files from certain decoders, e.g. Pactor-II. Depending on the individual decoder various file types are produced. In general, files with the extension *.bin* hold binary data and will be displayed in the HexEditor specified in the PMO configuration file. Files with the extension *.xdat* are in XML format and hold information about the content of the binary files. This file type is displayed in the text editor specified in the PMO configuration file.

The desired files are opened immediately in the dialog window. Double click the respective folder *XXX – Emission* to view the files available. Subsequently, to play the file, simply double click the respective file, or use the popup menu. Note that the media player will play all subsequent audio files, if any, once the first file played is finished.

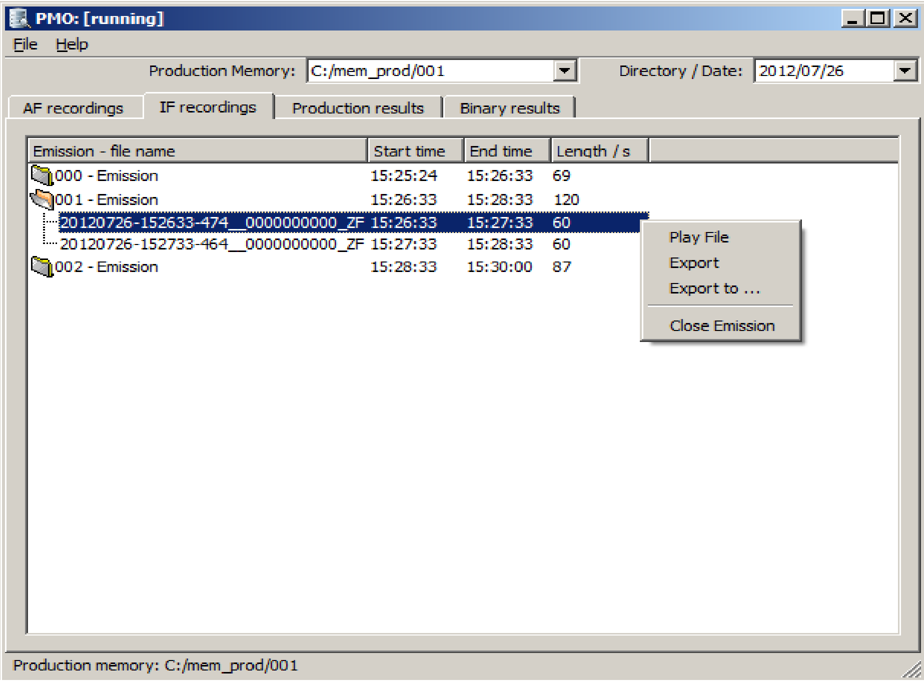


Figure 110 User Interface with Popup Menu

Control of PMO

The popup menu of PMO provides useful tools for playing, exporting, and file or emission handling.

Figure 111 Popup Menu PMO

When exporting, the files and emissions are converted from raw file into *.wav* format. On clicking *Export,* the file is saved to the most recent directory without any confirmation prompt (default directory is the user's home directory - in cases of doubt please consult your system administrator). *Export to…* opens a *Save File* dialog box for selection of the desired directory.

Manual Analysis of Unknown Signals

go2DECODE is an efficient tool for manual analysis and processing of unknown modulated signals. There are three different basic processing steps:

- Determine modulation parameters
- Demodulate signal
- Decode contents

The following table provides typical measuring and processing functions:

Function	Application Examples
Spectrum/Sonagram Display	Input signal monitoring Bandwidth measurement Measurement of signal start or signal end Burst length measurement Measurement of shift with FSK
Spectrum Display	Frequency and level measurements Squaring to detect PSK signals
Eye Pattern Display	Measurement and control of symbol rate and signal quality Measurement at the time signal (oscilloscope)
Constellation Display	Determination of type and modulation order with PSK/QAM The function Difference Phase creates an upright display even if the parameters of the signal frequency have not been set exactly.
Bit Display Hell Display	Detection of frames, patterns, synchronous words, etc. in the demodulated data stream
Online and Offline Analysis	With a signal memory of 5 min., which automatically takes records in online mode, i.e. the last 5 min. are available for analysis after switching to offline mode
Cursor Functions Harmonic Cursor	Measurements of time, frequency, amplitude, angle, level, etc. This cursor allows for precise measurement of signals with equidistant contents (symbol rate, harmonics, etc.)
Universal analysis demodulator with free parameter setting	Processing of the signals down to bit level. The temporary results of the demodulator (AM demodulation, FM demodulation, filtered time signal, and many others) can be used immediately as an input for analysis displays (expanded analysis options, e.g. analysis with symbol rate, in the centre of the symbols, via demodulated signal contents, etc.)
Spectrum via AM demodulated time signal	Determination of the symbol rate with unknown signals (modulation type also unknown)
Universal, freely programmable decoder	Decoding of the demodulated data stream
Fast visualising (up to 1,000 FFT/s) and direct parameter	Assists in the processing of signals and gives the impression of an analogous measuring device

editing	

Table 64: Measuring and Processing Functions

Activate Manual Analysis

Apply the unknown signal to the input and start go2DECODE. The displays shown on application may vary depending on the current presetting (Autostart). Select the mode *Analysis Online* and press the <**Start**> button to start the signal flow. If not yet active, start the *Spectrum/Sonagram Display* to obtain an overview of the signal applied to the input.

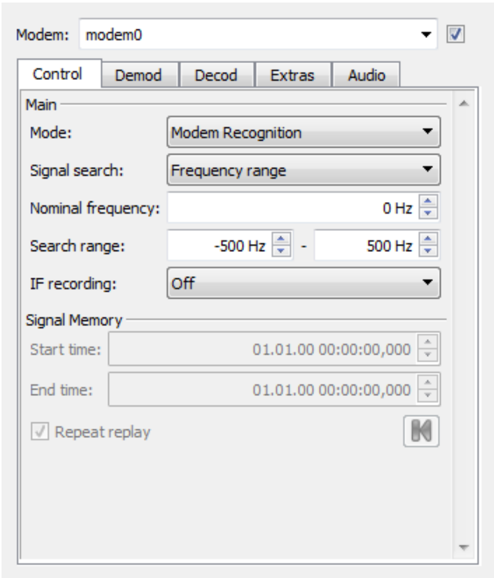


Figure 112 Control Tab on Property Sheet

Normally, a known signal will be demodulated and decoded automatically if the parameters have been entered into the knowledge base. Deactivate the automatic mode *(Automat)* to switch to manual processing. To do so, click the <*Control*> tab in the property sheet. If activated (i.e. engaged), deactivate the button <**Automa**t>.

We recommend to create a new (blank) modem to avoid unintentional modification of the stored modems. Select the menu item *New modem* on the *Modem* menu (the drop-down combo box now shows the default name *modem0*).

Analyze FSK Signals

This paragraph describes typical methods for a manual analysis of FSK modulated signals. For this purpose, we shall use the example file *5-2_FSK_example.wav* stored in the directory *examples\analysis* in your Application directory, applied to the *Sound* input of DANA. Please replay the example file with a media player.

Adapt Display Area to Input Signal

There is a chance that the displayed spectrum of the signal is outside the adjusted display zone as shown in the following examples:

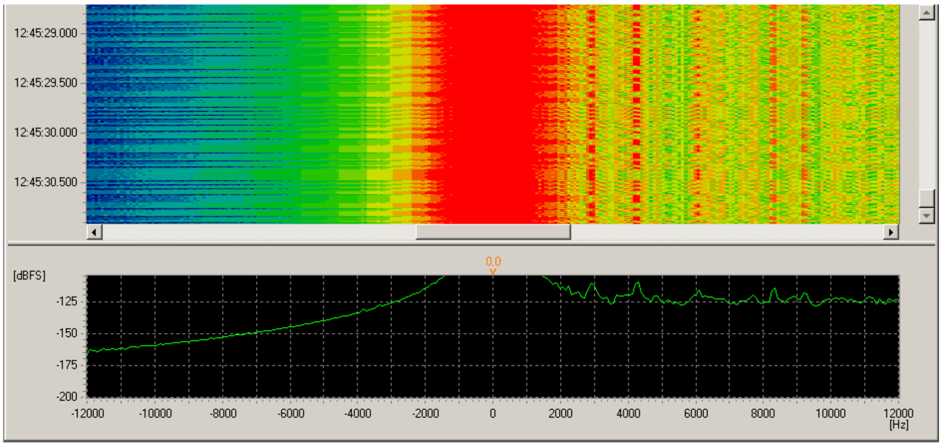


Figure 113 Spectrum Outside

Inadequate scaling will cause the display of an overmodulated signal where the signal characteristics will be impossible to view.

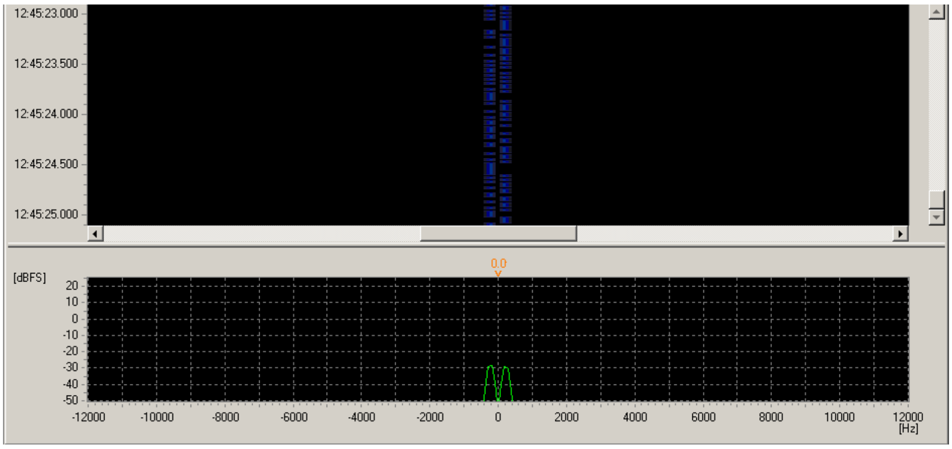


Figure 114 Display of Overmodulated Signal

Due to the inappropriate scaling, the signal can be hardly recognized in the figure above.

Press the button <**Autorange**> to set the scaling automatically. This button is located at the bottom of the spectrum/sonagram display property sheet.

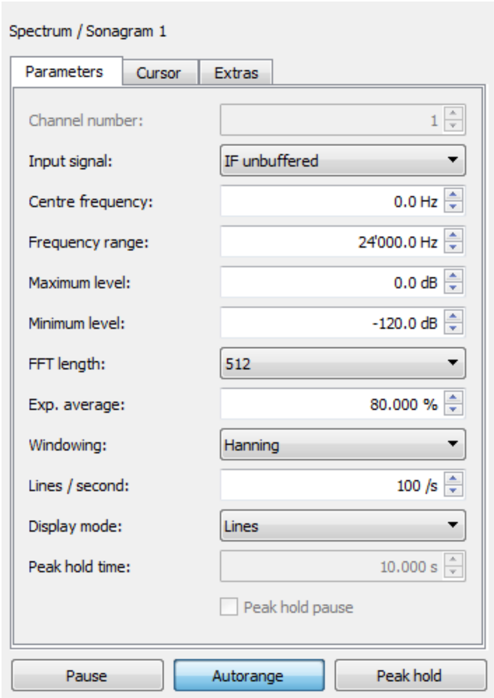


Figure 115 Spectrum/Sonagram Parameters Tab on Display Property Sheet

Subsequently, the spectrum/sonagram should have the following appearance:

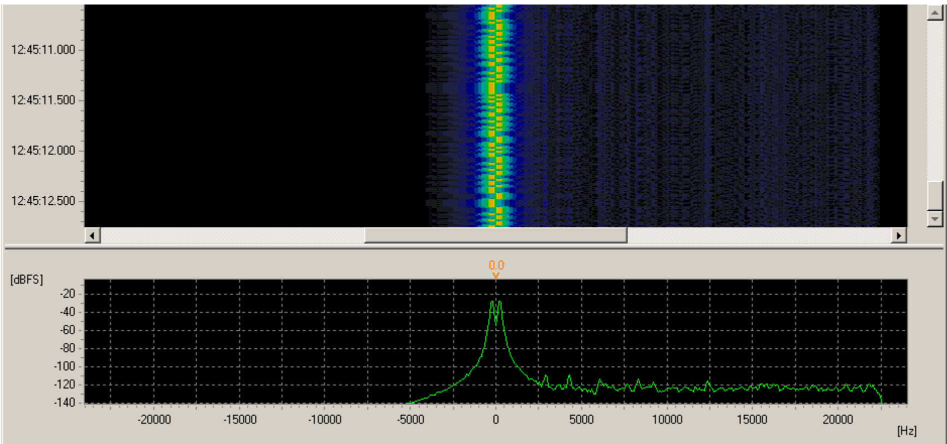


Figure 116 Corrected Scale

The FSK signal is clearly visible in symmetry with the origin. The noise level is -125 dBFS.

The demodulators expect to receive their signal in a symmetrical arrangement around the centre (0 Hz). If the input signal is outside the centre, adjust the signal by use of DANA (parameter *Output Signal - Frequency*). A coarse setting is sufficient to carry out the following analyzing steps.

Measure Signal Centre and Shift

Activate the checkbox ☑ *X-Cursor* on the <*Cursor*> tab in the display control to obtain an enlarged view of the relevant areas of the spectrum.

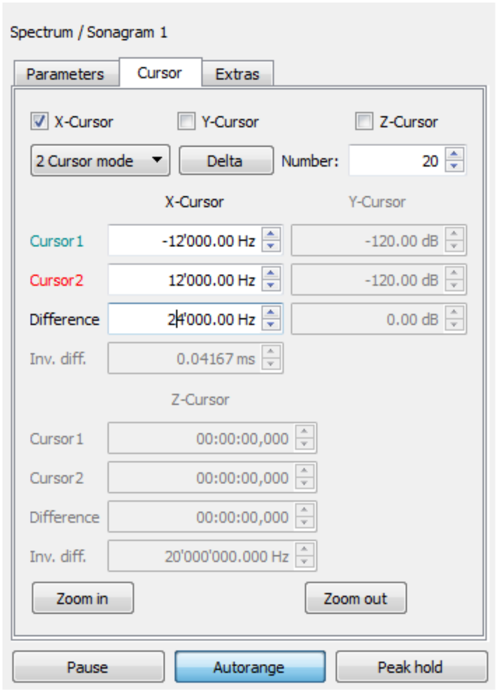


Figure 117 Cursor Tab on Display Property Sheet

Two cursors (red and green) will appear in the sonagram. Both can be freely positioned using the mouse. Position one cursor each on either side of the signal, next press the button <**In**> on the <*Extras*> tab to obtain an enlarged view of the section delimited by the cursors. Repeat this process until the spectrum area displayed is satisfactory.

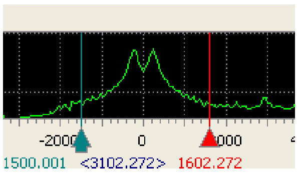


Figure 118 Two Cursors Positioned Around the Relevant Spectrum Area

The spectrum/sonagram now should resemble the display in the following figure:

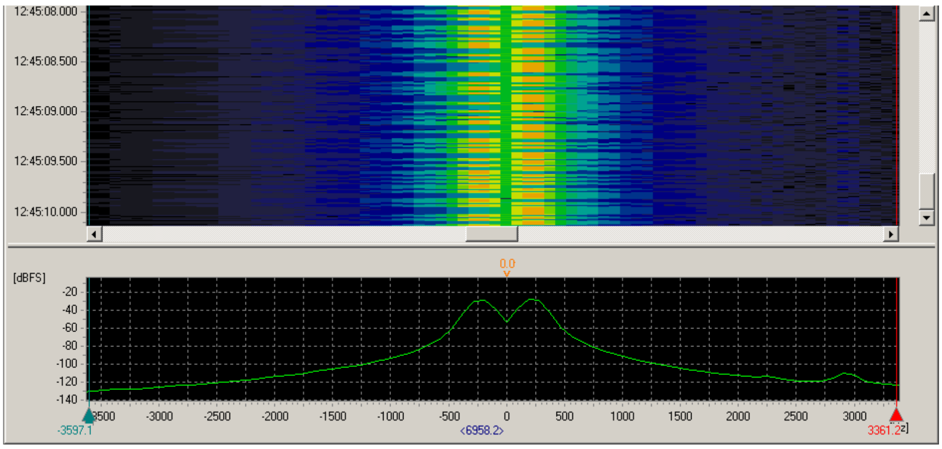


Figure 119 The Enlarged Spectrum has a Low Resolution

FFT Length 512

To improve the frequency resolution, increase the FFT length on the <*Parameters*> tab (exemplary values: 2048, 4096 or 8192). As expected, this is achieved at the expense of the quality of the time resolution, which will deteriorate (the blanking of the signal is impossible to recognize in the sonagram).

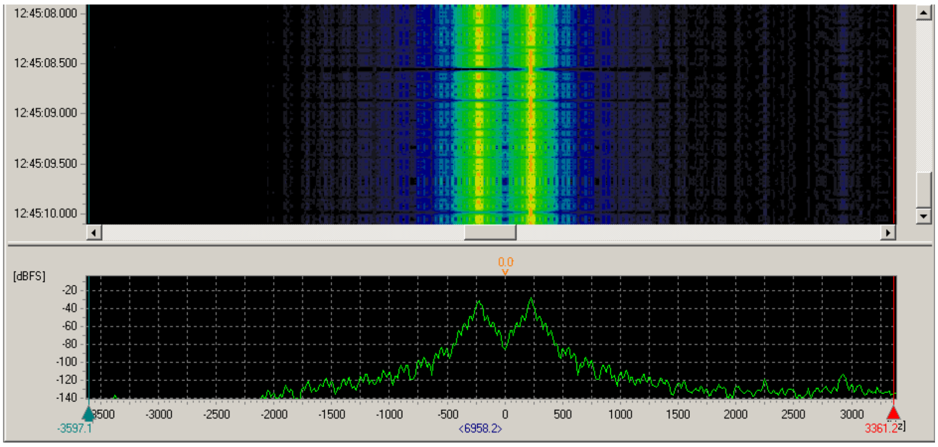


Figure 120 Increased Spectrum Resolution

FFT Length 4096

The shift is the distance between the two exterior shift-keying frequencies (strong signal peaks). Activate the button <**Peak Hold**> on the property sheet to localize the exact position of the peaks and to measure the distance between them.

A red line is created every n seconds, depicting the maximum amplitudes. The length of this time interval can be adjusted manually in the spin box *Peak Hold Time* on the <*Extras*> tab, if necessary.

Place one cursor each on the maximum positions. Read out their exact positions and distance on the frequency axis:

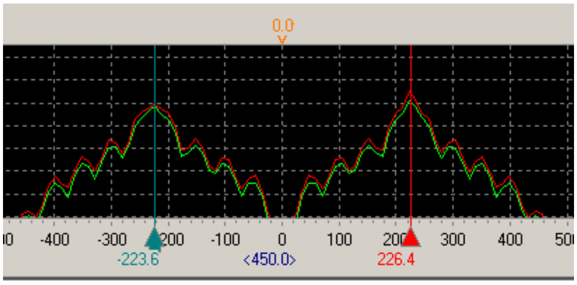


Figure 121 Spectrum Display with Peak Hold Curve

Consequently, the shift is of 450 Hz approx., which supplies the second demodulation parameter.

Determine Symbol Rate in Sonagram

Due to the time resolution, measuring the symbol rate in the sonagram display will only make sense with low symbol rates (<100 Bd).

Expand the window by dragging the lower margin downwards for optimum working conditions.

Since the measuring of the symbol rate will not require a precise frequency resolution, set the FFT length to a value at which the symbols are clearly recognized. In this case, said value is 512.

The number of rows created per second must be increased considerably to allow for visual recognition of the time shift between the two frequencies. This is achieved by changing the value in the spin box *Lines / Second* on the <*Parameters*> tab. Appropriate values would range e.g. from 600/s to 1000/s.

Press <**Pause**>. The screen should now resemble the following figure:

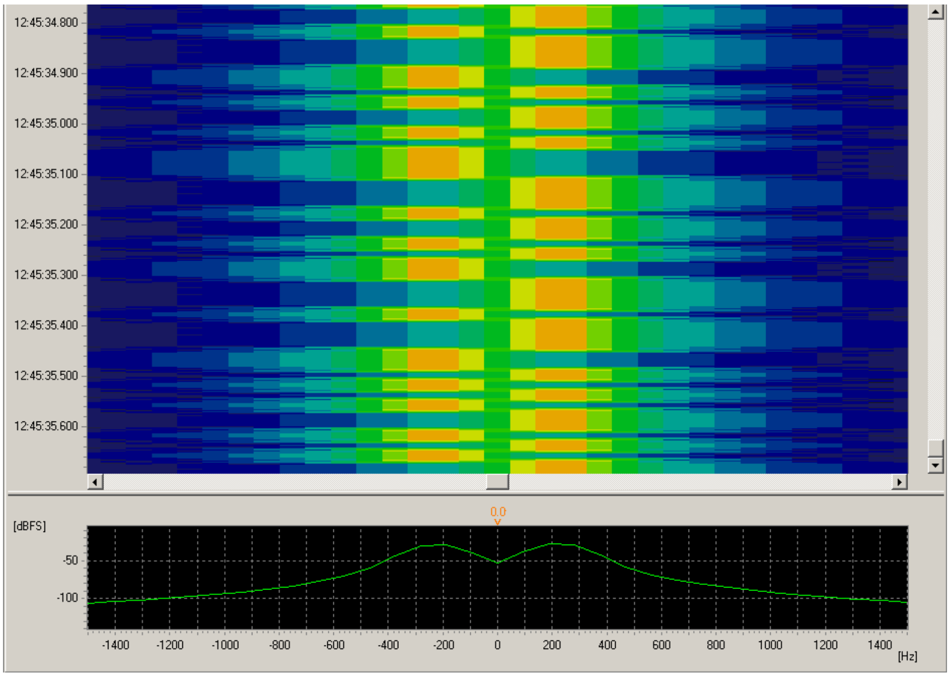


Figure 122 Zoom in of the Spectogram

The sonagram has been expanded. The number of rows created per second has been increased considerably. The exact shift between the frequencies can clearly be seen.

Now activate the checkbox ☑ Z-Cursor with the extension ☑ Harmonic on the <*Cursor*> tab. Additional red cursors will appear at equidistant distances to the green and the red cursors.

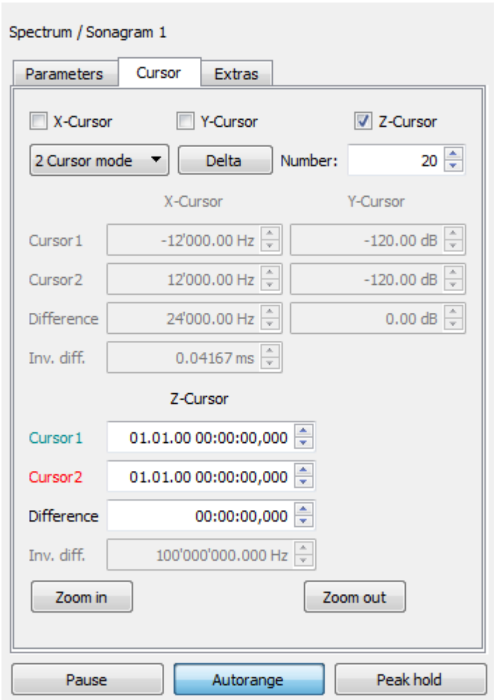


Figure 123 Cursor Tab on the Display Property Sheet

The distance between two adjacent cursors is 0.020 s.

Drag these cursors to create a grid on the frequency changes. The distance between two cursors must exactly coincide with the shortest recognizable time as shown in the following figure:

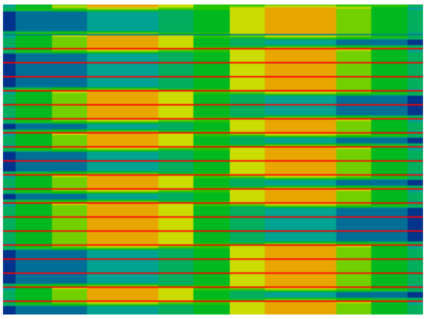


Figure 124 Frequency Response Characteristics with Grid Overlay

The frequency changes are now integrated into a grid. The shortest time is located exactly between the two cursors and corresponds to one bit.

Read out the distance between two adjacent cursors from the cursor positions on the X-axis or on the property sheet.

According to the formula: $SR = 1 / T_{bit}$, the symbol rate then is 50 Bd.

In the next step, return to the standard display without cursors and deactivate the button <**Pause**> on the property sheet.

Please note: The display will not be updated while set to <Pause>. However, this will not affect the internal processing and the display in other windows. To suspend all processes currently active, click the button <**Stop**> on the <*Control*> tab on the property sheet.

Determine Symbol Rate by Spectrum via Envelope

Depending on the modulation type (typically with ASK, FSK, QAM, and many others), changes of symbols frequently coincide with abrupt energy decreases. When calculating a spectrum via the signal envelope, a peak or an abrupt decrease will occur on the location of the symbol rate, depending on the characteristics of the individual signal.

Signals that are suitable for input for the displays are generated in the demodulators. Consequently, the signal selection and the signal characteristics (bandwidth, scanning rate, etc.) will be affected by the parameters of the demodulator.

To use the input signal *Diff. Magnitude* as an input as shown below, select the demodulator *FSK2 matched*. Enter the measured shift parameter and make a rough estimation of the symbol rate, or select a high value.

This measuring process also can be carried out using the input signal *Magnitude* in the demodulator *ASK2.*

Open the *Spectrum* display via the toolbar. The entire frequency spectrum is displayed. As in all windows of this type, the characteristics of this display are shown on the property sheet.

Contrary to the sonagram, this option serves to select additional views via the drop-down list box *Input Signal* (on the <*Parameters*> tab). Select *Diff. Magnitude*. This display will show a significant and abrupt energy decrease at the position of the Baud rate.

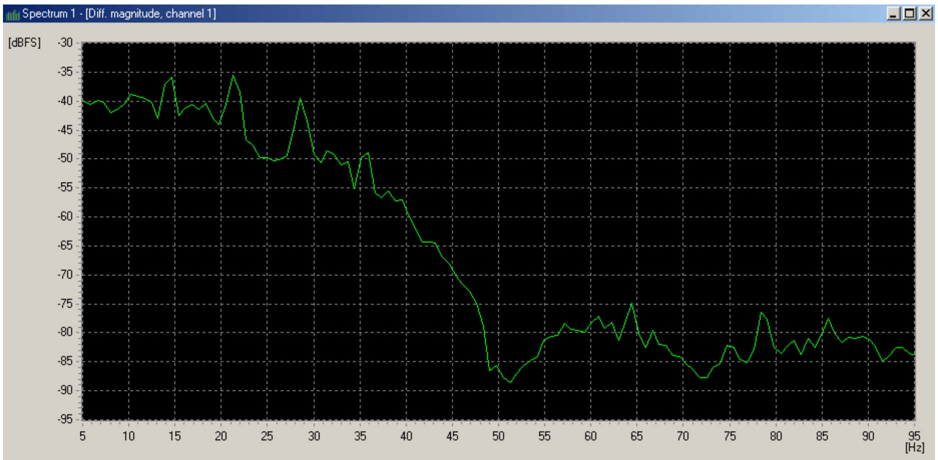


Figure 125 Spectrum over the Envelope Curve (Difference Magnitude) of the FSK Signal

The measuring accuracy can be increased by selecting a greater FFT length and by zooming in the range around 50 Hz (using the X-cursor).

Further, you may select another procedure alternatively: Enter 50 Hz as the *Centre frequency* and 80 Hz as the *Frequency range* on the <*Parameters*> tab. The spectrum will display the frequency range between 10 Hz and 90 Hz.

Determine Symbol Rate by Measurement in Time Signal

Another method is to measure the time interval between the symbols. This requires a demodulation of the signal, i.e. the appropriate modulation type must be known. The symbol rate can be roughly estimated but the parameter value entered must be equal to or greater than the actual value.

Select the demodulator to *FSK 2 matched*, enter the measured shift and a symbol rate of 200 Bd (intentionally a greater value). Select the display type *Eye pattern display* (on the *Display* menu or the toolbar) and the input signal *Diff. Magnitude*.

Difference magnitude is an intermediate step in demodulation, where the signal is demodulated still without knowing the symbol rate. However, the individual data bits are visible as a result. Therefore, a rough pre-selection of the symbol rate is required to prevent the demodulator from selecting too low a bandwidth for filtering and too low a scanning rate for the signal.

With strong noise or external signals, excessive bandwidths (greater symbol rate selected) may cause distortion signals to be visible in the difference magnitude.

Select a time interval for the eye pattern display permitting to recognize several symbols (in this case e.g. 400 ms):

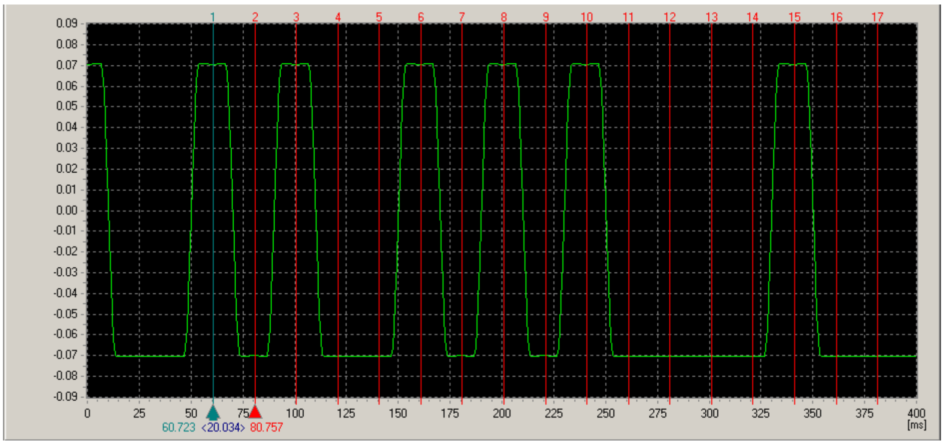


Figure 126 Eye Pattern Display via Difference Magnitude

The demodulated symbols are clearly visible.

In order to measure, simply switch the display to <Pause>. Activate the checkboxes ☑ *X-Cursor* and ☑ *Harmonic*. Use the cursors to measure the distance of the symbols. In this case, the individual cursors have been positioned on the centre of the symbols. Another option is to use the symbol edges as reference points.

According to the formula: SR = 1 / T_{bit} , the measured symbol interval of 20.07 ms results in a symbol rate of 49.83 Bd.

Measure Shift and Baud Rate via Demodulator

Further, the demodulator itself can be applied for automatic measurement of the shift and the symbol rate. Select the demodulator FSK2 matched and enter the roughly measured shift and symbol rate magnitudes.

Note: When using the demodulator *FSK2 matched,* and provided the search is carried out with the *Automat,* nominal frequency or search range, note that the shift will, in addition to the demodulator measurement, be measured automatically if the tolerance value entered is greater than half the shift value or greater than 1.2 * symbol rate. The measuring result is sent to the demodulator.

Result display

No.	Name	Detection	QDet	QSig	QSR	Decod	DMM	SR	Shift	Nominal offset	Bu
046	QPSK31	none	56 %	9 %	59 %	no sync	No	31.8 Bd	0.0 Hz	-0.0 Hz	
047	RUM-FEC 165Bd/400Hz	none	20 %	98 %	0 %	no sync	No	169.2 Bd	450.7 Hz	15.2 Hz	
048	SI_FEC	none	36 %	29 %	53 %	no sync	No	95.7 Bd	246.0 Hz	0.7 Hz	
049	SITOR-A 100Bd/170Hz	none	0 %	-	-	no sync	No	-	0.0 Hz	0.0 Hz	
050	SITOR-B 100Bd/400Hz	none	17 %	83 %	0 %	no sync	No	100.0 Bd	448.4 Hz	44.4 Hz	
051	Sprache J3E	none	0 %	-	-	-	No	-	0.0 Hz	0.0 Hz	
052	Swed-ARQ 100Bd/400Hz	none	14 %	100 %	0 %	no sync	No	100.0 Bd	451.0 Hz	0.1 Hz	
053	Twinplex 115-170-515	none	0 %	-	-	no sync	No	-	0.0 Hz	0.0 Hz	
054	**FSK2 matched**	**modul. tracking**	**96 %**	**100 %**	**79 %**	**-**	**No**	**50.0 Bd**	**449.9 Hz**	**0.0 Hz**	

Figure 127 Result Display

The Measuring Values of the Demodulator are shown in this table.

The measuring values of the active demodulator are highlighted in green in the result display (*Display* menu or toolbar). The symbol rate and shift values can be read out directly from this table.

To be on the safe side, verify the quality of the signal *(QSig)* and the symbol rate *(QSR)*. Values of less than 50% indicate either a severe distortion of the signal, selection of an inappropriate demodulator, or inadequate parameter settings, all of which may cause a bad result.

Another method to verify whether the demodulator has a correct symbol rate can be applied in the eye pattern display. Set the eye pattern display to the signal input *Filtered diff. mag.* Set the *Display Type* to *Eye pattern display* and increase the *Number of vectors* to e.g. 20.

Modify the parameter *Time period* to a value that will make one to three symbols visible. In the mode *Eye pattern display*, the start time of the display is synchronized with the symbol rate from the demodulator. The result will be an “eye“, provided an appropriate symbol rate has been selected:

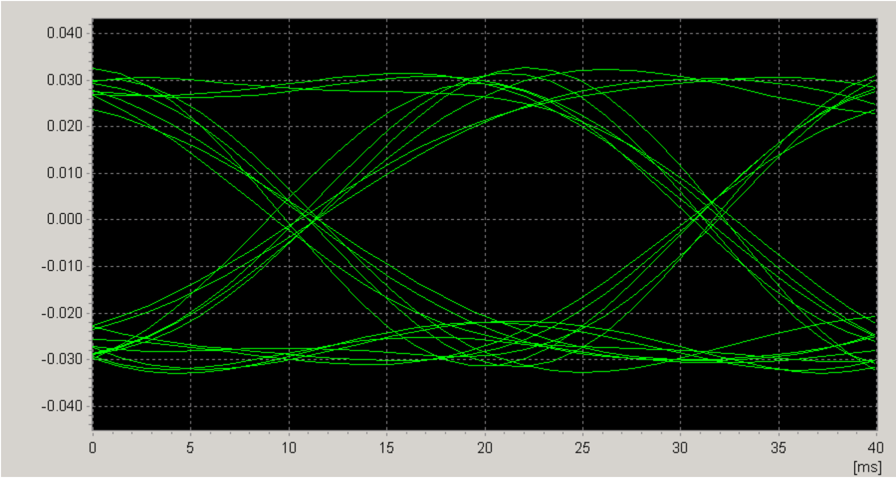


Figure 128 Eye Pattern Display with Filtered Difference Magnitude

If there is no visible “eye“, the symbol rate of the demodulator is incorrect.

Search for Repeating Frames in Demodulated Bit Stream

Activate the bit display (*Display* menu or toolbar) to display the demodulated bits:

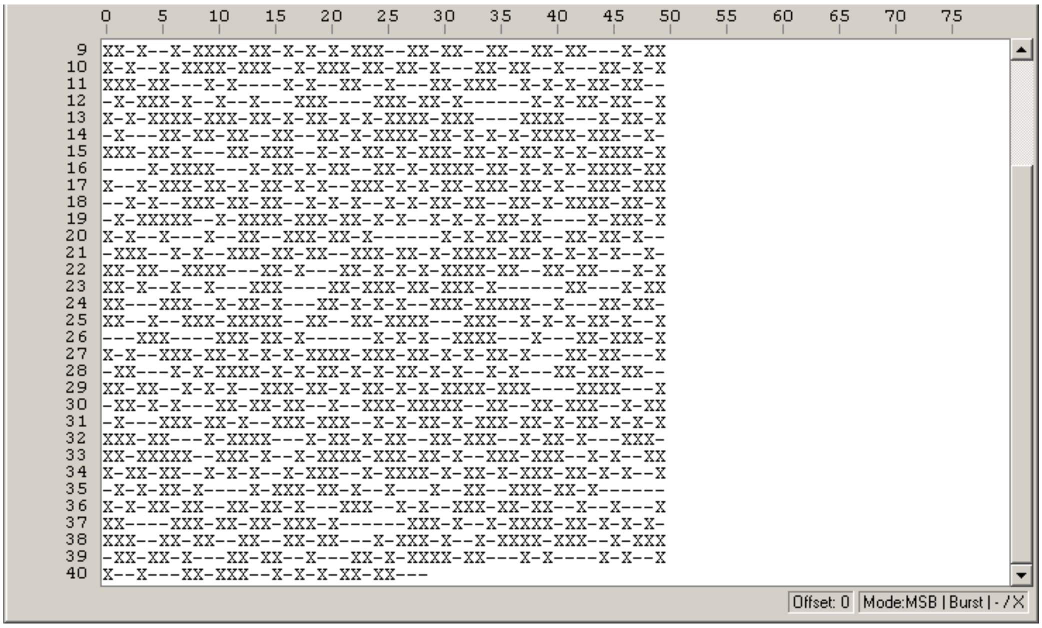


Figure 129 Bit Display of Demodulated Bits

A typical search is for repetitions in the data stream. Modify the parameter *Circulation length* and check the display. Once a pattern shows up, the circulation length corresponds to the repetition length or a multiple of its magnitude.

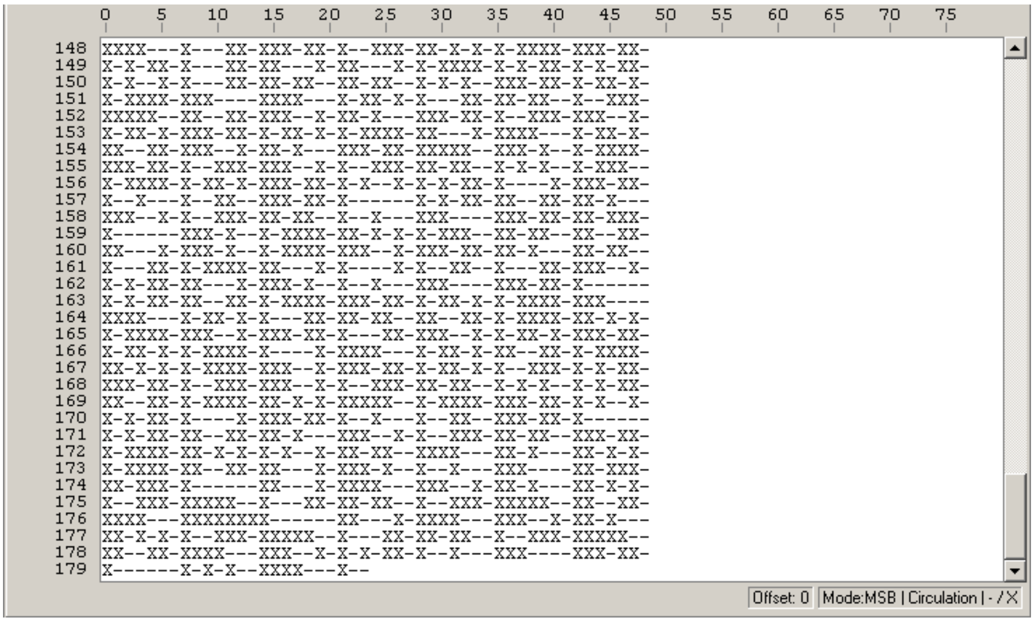


Figure 130 Bit Display

Circulation Lengths Corresponding to a Multiple of the Repetition Rate Will Cause “Frames“

Decoding

The message in the example used was encoded by means of the Baudot modem (in this case with one start bit and one stop bit). To obtain this message, select the appropriate decoder: Press the button <**Decoder name…**> on the <*Decod*> tab. Select *baudot11* and confirm with <OK>. The decoded message is displayed in the result window:

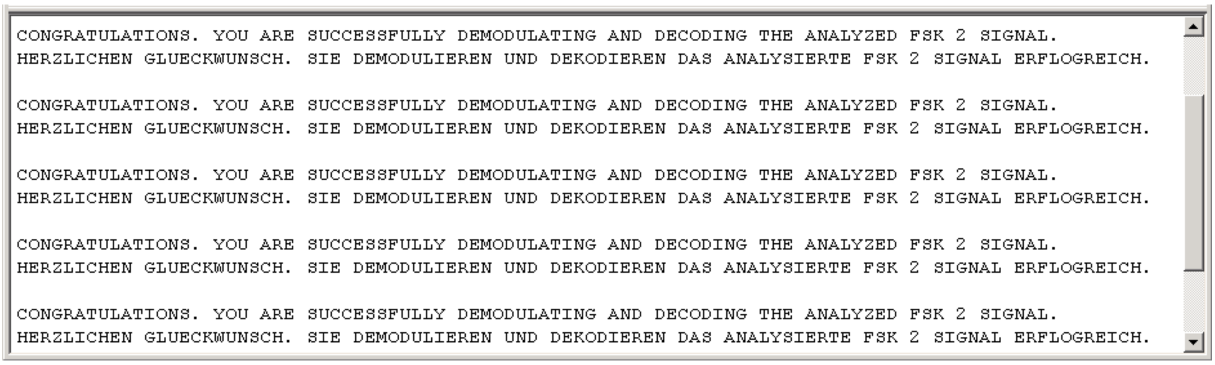


Figure 131 The Decoded Text is shown in the Result Display

Save Modem

At this point, the essential parameters of your modem have been defined. Edit the name in the drop-down list box *Modem:* on the control property sheet (e.g. "My first modem" or "FSK2 450/50 Baudot11"). Save the modem by selecting the menu item *Save modem to file...* on the *Modem* menu. Enter the desired file name (e.g. "test" or "my_fsk.ver") and click the button <**Save**>. In the automatic mode of go2DECODE, the modems analyzed will be recognized automatically.

Decoder Adaptation and Development

Provided the source code for the supplied decoders is available, you may adapt or modify the decoders to suit your requirements. Additionally, new decoders can be created to execute other modems by use of the description language DDL *(Decoder Description Language)*. DDL is a simple programming language developed specifically for signal decoding tasks.

Create Decoder

The following figure is an overview of all elements required to create and operate a decoder.

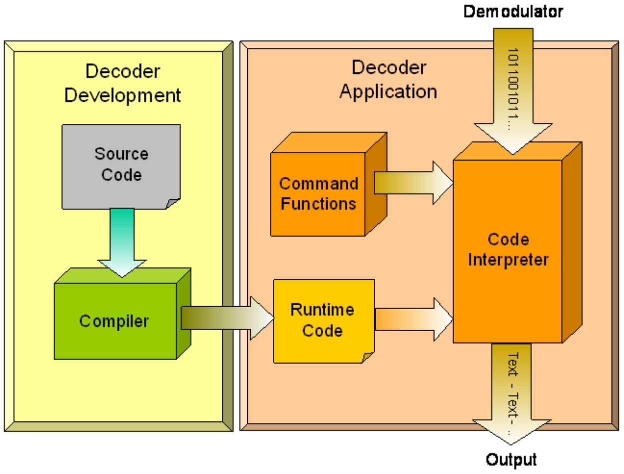


Figure 132 Overview of Decoder Creation

The decoder function is entirely defined in a source code, which can be created in basically any ASCII text editor. The source code comprises the command steps and the sequence in which these are to be processed during decoder application. A compiler translates this text into a code, which can be interpreted easily and quickly during the runtime of the decoder. The source code and decoder code are stored in files.

The code files created this way are used when integrating decoders in completed modems and when processing these modems.

Edit Decoder

Load Editor

To call the source codes of the decoders, use the *<Decod>* tab as shown in the figure below. This is only possible if the decoder source code is available in your installation. Decoders requiring a special license option are not supplied with their source code.

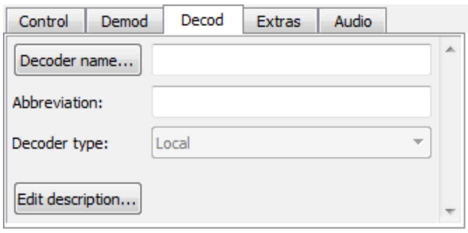


Figure 133 Load Decoder Editor

The editor window is displayed as shown below, together with a description of the selected decoder. The various language elements are automatically displayed in different colors for improved overview. The color assignment is as follows:

Colors	Language Elements
Green:	Comments
Red:	Designators of program sections
Blue:	Command functions and branch commands
Yellow:	System variables
Black:	Remaining text

Table 65: Decoder Editor Color Assignments

The editing and adapting functions are the same as in any standard text editor.

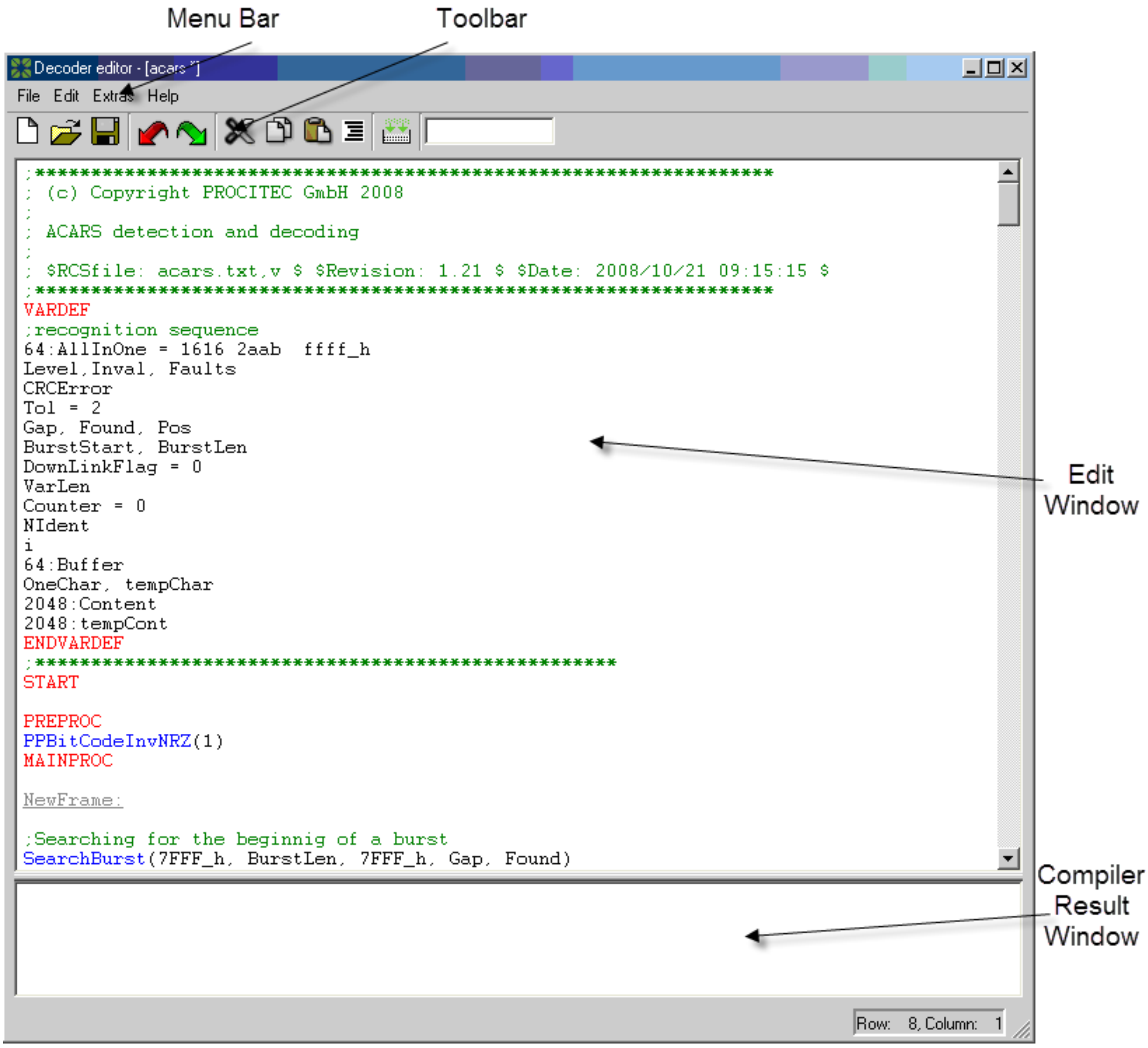


Figure 134 Decoder Editor

Menu Bar

Figure 135 Menu Bar

The menu bar consists of five menus, featuring the following menu items:

Menu Item	Function
File	Management of decoder descriptions
Edit	Editing functions and decoder creation
Extras	Automatic indentation, parameter information, and mass compilation
Help	Instruction Manual to Decoder Description Language DDL

Table 66: Decoder Editor Menu Items

File Menu

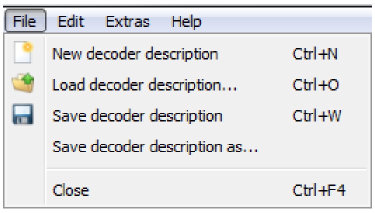


Figure 136 File Menu

Menu Item	Function
New decoder description	Remove all decoder descriptions previously displayed to release a new description
Load decoder description…	Load existing decoder description
Save decoder description	Save new / modified description
Save decoder description as…	Save decoder description using a new file name
Close	Close editor windows

Table 67: Decoder Editor File Menu Items

Edit Menu

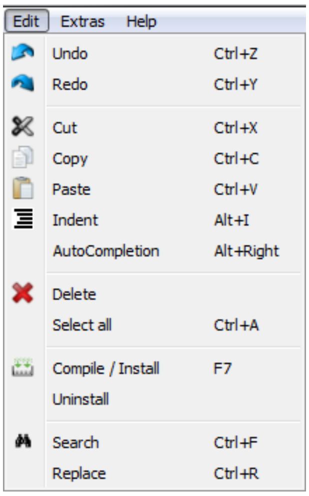


Figure 137 Edit Menu

The *Edit* menu comprises the standard editor commands:

Menu Item	Function
Undo	Undo last change
Redo	Redo change undone
Cut	Cut highlighted text block (and copy to clipboard)
Copy	Copy highlighted text block to the clipboard
Paste	Insert clipboard contents at cursor position
Indent	Correct right and left indentation of highlighted text
Auto Completion	Complete DDL command entry automatically
Delete	Delete highlighted block
Select all	Highlight the complete text
Compile / Install	Compile the edited text and create a code that is interpretable during the decoder runtime. The decoder code thus created is installed in the connected signal-

Menu Item	Function
	processing channel
Uninstall	Remove decoder from the connected signal-processing channel
Search	Search the entire text document for a specifiable text
Replace	Replace the specified text with another text

Table 68: Decoder Editor Edit Menu Items

Extras Menu

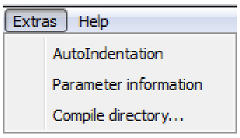


Figure 138 Extras Menu

The Extras menu provides three items to facilitate the editing.

Menu Item	Function
Auto Indentation	Automatically insert as many blanks as in the previous line.
Parameter information	Show list of available parameters for valid DDL commands.
Compile directory	Compile all decoders in specific directory.

Table 69: Decoder Editor Extras Menu Items

Help Menu

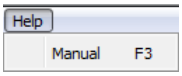


Figure 139 Help Menu

This menu features the item *Manual,* which serves to display the Instruction Manual to the Decoder Description Language *DDL*.

Toolbar

Specific functions can be executed via mouse click immediately on the toolbar.

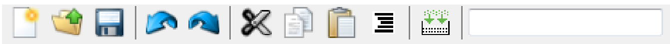


Figure 140 Toolbar

The following functions are available:

Icon	Function
	New decoder description
	Load decoder description from file
	Save decoder description to file
	Undo
	Redo
	Cut
	Copy
	Paste

	Indent
	Compile

Table 70: Decoder Editor Toolbar Icons

Shortcuts for Decoder Creation

Shortcuts serve to quickly access specific functions in the creation of decoders.

Function	Shortcut
New decoder description	Ctrl + N
Load decoder description	Ctrl + O
Save decoder description	Ctrl + W
Undo	Ctrl + Z
Redo	Ctrl + Y
Cut	Ctrl + X
Copy	Ctrl + C
Paste	Ctrl + V
Indent	Alt + I
Select all	Ctrl + A
Search	Ctrl + F
Replace	Ctrl + R
Open context-sensitive DDL help	F3
Compile	F7

Table 71: Decoder Editor Shortcuts

Context-Sensitive Help

This function serves to display the documentation on a valid DDL command. To do so, position the cursor on a DDL command in the decoder editor and press <**F3**>. Subsequently, the software opens the PDF documentation and searches the DDL Operating Instructions for the current DDL command. In case the current text string is no valid DDL command, the search will not produce any result.

The precondition for the correct function of the context-sensitive help is an existing DDL Operating Instructions file.

Automatic Command Completion

When entering a DDL command, the software can complete the current text entry automatically into a DDL command. Activate this function by means of the shortcut <Alt>+<→>. If the entry unequivocally matches a DDL command, the missing characters are inserted immediately upon activation of <Alt>+<→>.

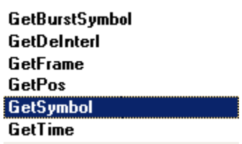


Figure 141 Automatic Command Completion

If the current text string matches several valid DDL commands, a list box is displayed showing the commands in question. The list box shows a maximum of ten possible completions. Select the desired com-

pletion using the arrow keys or the mouse. Insert the entry selected in the list box at the current text position by pressing <**Return**> or double clicking the desired item.

Exit the list box at any time via <**Esc**> or clicking any position outside the list box on screen.

If no valid DDL commands match the current entry, you will see an alert message *(Completion not possible)* on activating <**Alt**>+<**→**>. The text string to complete must consist of at least two characters.

Automatic Indentation

On pressing <**Return**>, this function inserts the same number of blank spaces as in the previous line. Additionally, it will insert two blanks after an *If, Case, For, Switch* or *While* command.

Activate and deactivate the automatic indentation on the *Extras* menu.

The setting remains unchanged on exiting the program and still be active next time you start the decoder editor.

Show Parameter Information

This function shows the list of available parameters for a valid DDL command when entering the bracket character. Output parameters are displayed in blue, optional parameters are in Italics. During the input, the current parameter is shown in bold and underlined characters.

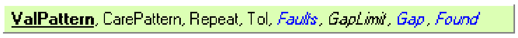


Figure 142 Decoder Status Bar

The parameter information remains on screen until you enter the character in the current line; or when clicking anywhere else on screen or when entering something else which is no valid DDL command or when scrolling the text in the editor pane.

Activate and deactivate the parameter information on the *Extras* menu. The setting remains unchanged on exiting the program and still be active next time you start the decoder editor.

Compile Directory

This function serves to compile all decoders in a specific directory. On activation of this item on the *Extras* menu, the program shows a dialog box for selection of the desired directory.

Decoder Source Code Structure

The Decoder Description Language is the basis for the source code for the description of decoders. Please consult the document *Decoder Description Language DDL* for a more detailed description of the structure and the various command elements. To view this document, use the *Help* menu or the <F2> hot key. The descriptions below will merely provide a rough and initial overview.

In general, the syntax of the decoder description corresponds to that of a simple programming language. Programs always begin with a declaration part which defines the variables used, followed by the actual description of the program flow, which uses both fundamental and very specific commands allowing for implementation of more complex decoder functions with only one command line. Schematic assignments such as alphabet encoding may be defined in separate tables. Reference to these tables can be made via specific commands in the course of the program flow.

Fig. 143 illustrates the basic structure of a description, using a simple decoder as an example. Every program is adapted to the general basic data flow as shown in Fig. 144. First, the incoming data stream is stored automatically in the input buffer where it is possible to search for specific data patterns or characteristics to identify the modem or to configure the start synchronization. Starting with the positions detected this way, the data stream can be read out and processed in steps. Optionally, pre-processing operations, i.e. the modification of the incoming data stream, can be carried out *before* saving the data in the input buffer.

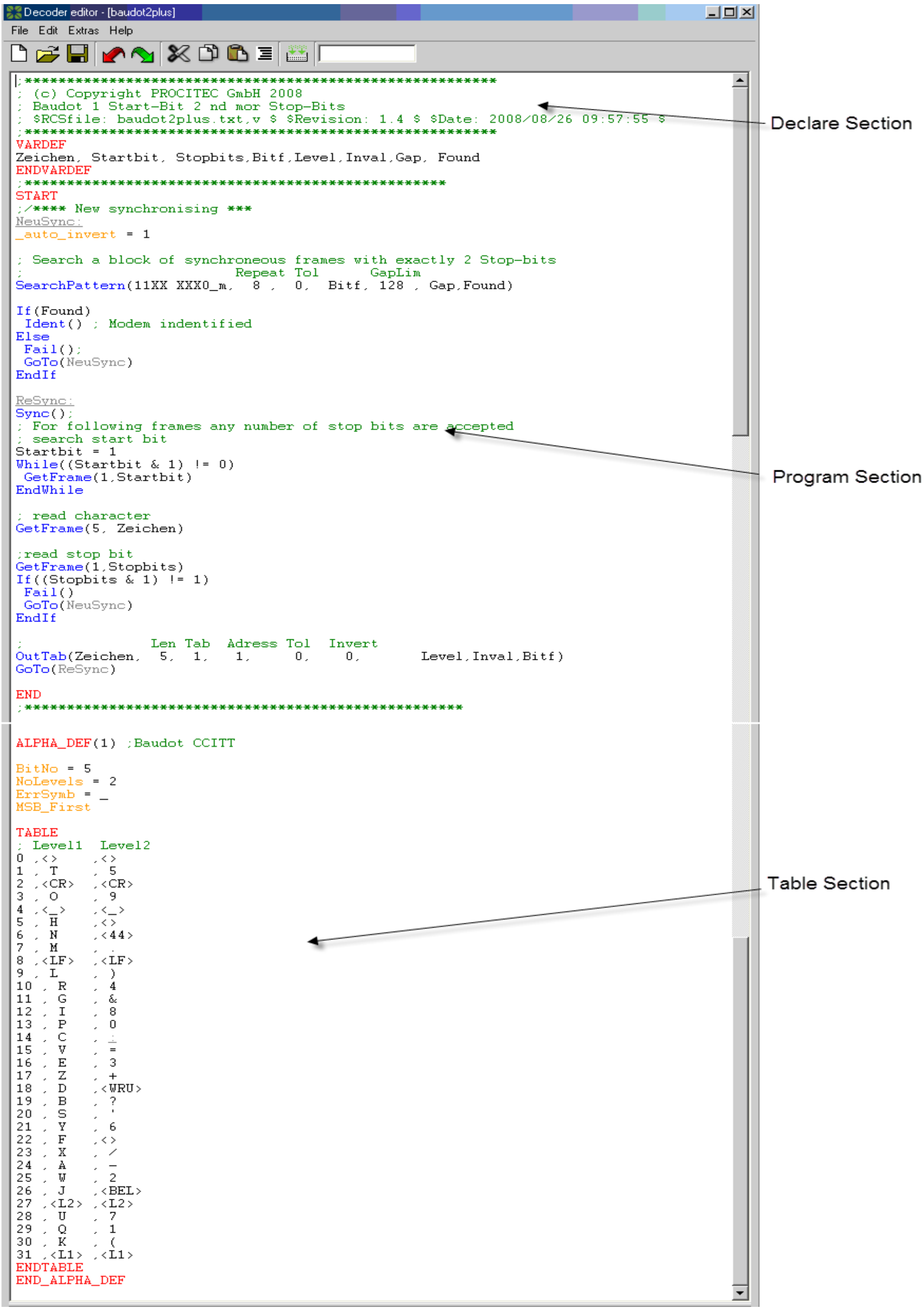


Figure 143 Example of a Decoder Program

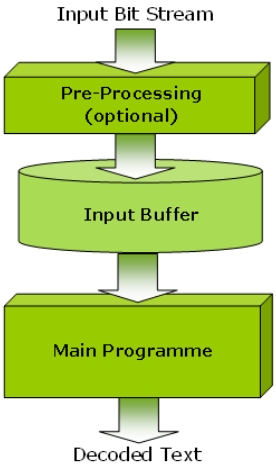


Figure 144 Decoder Data Flow

Most of the programs apply a choice of the following command types:

Search Commands (starting with Search...)

These commands search for special patterns and identification characteristics within the input buffer which is refilled after each call. The search can be made with error tolerance. These commands are required for both the identification of an encoding and the synchronization of an appropriate start position.

Examples:

Command	Functions
SearchPattern	Search for specific bit patterns
SearchSymbolTab	Search for symbols defined in a table
SearchInterlSymbolTab	Corresponding search of interleaved symbols
SearchBurst	Search for the start of a burst
SearchPolynom	Search for an output bit sequence of a feedback shift register LFSR
SearchVectorPatternMatch	Search for patterns consisting of multi-order input symbols (for example PSK8 sequences).

Table 72: DDL Search Commands

Read Commands (starting with Get...)

These commands initiate the reading of data blocks from the input buffer in variables:

Examples:

Command	Functions
GetFrame	Read specific quantity of bits
GetDeInterleave	Read specific quantity of bits according to a definable interleaving pattern
GetSymbol	Read specific quantity of multi-order input symbols

Table 73: DDL Read Commands

Frame Fragmentations and Reformatting

Distributed or interleaved bit sequences can be composed in various ways.

Examples:

Command	Functions
Extract	Extract bit frame from variable, with or without bit reversal
ExtractInterl	Extract interleaved bit frame

Command	Functions
ExtractPattern	Extract word distributed in freely definable bit positions
Destuff	Delete stuffing bits
Join	Join two bit sequences

Table 74: DDL Bit Maniupulation Commands

Check and Correction Methods

Examples:

Command	Functions
CheckCRC	Execution of Cyclic Redundancy Checks
CorrectExtGolay	Error correction of an Extended Golay Code
TestPolynom	Test whether a bit sequence was created by a linear feedback shift register (LFSR)
Weight	Count the quantity of ones in a test word
ViterbiHDD	Decode and correct convolutional code according to Viterbi Hard Decision Algorithm.
IsTabSymb	Check whether a bit sequence consists of valid symbols of a symbol table

Table 75: DDL Check and Correction Commands

Operators and (=, +, -, /, *, &, |, && ...)

Arithmetic, binary and logical operators, as well as bracket operators, can be nested deliberately for use in assignment equations or parameter assignments. The syntax follows the structure of the programming language C.

Branch Commands (If, While, For, GoTo)

Create conditional or unconditional branches and loops.

Output Commands (starting with Out...)

This group of commands serves to output results to specific result addresses (displays, database categories, etc.). To a certain extent, these commands can also convert table code in one step.

Examples:

Command	Functions
OutTab	Decoding of a bit field according to a symbol table (for example character alphabets) and output
OutTabHuffman	Same function for Huffman alphabets (unequal symbol lengths)
OutText	Output of any additional text
OutVal	Output of a numeric value
OutTimeStamp	Output of a time stamp to a specific bit of the input buffer

Table 76: DDL Output Commands

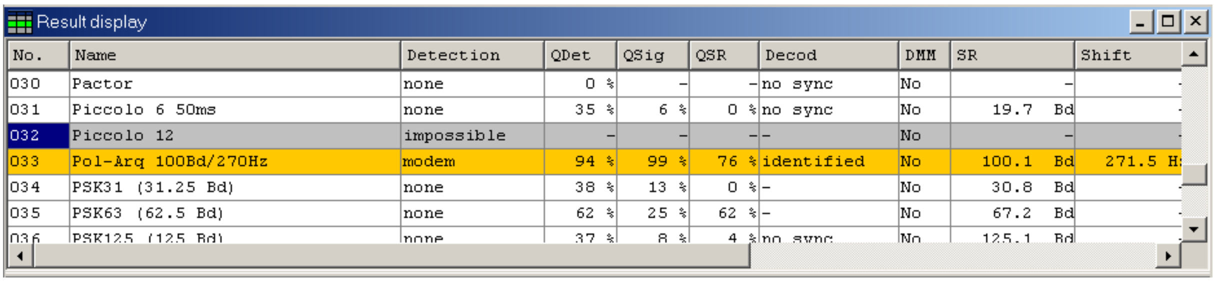
Control Commands

These commands serve to provide the calling production *Automat* with messages such as identification of the correct modem, defined loss of identification, or status of process ability without any identification statement. Using these commands is the precondition for flawless automatic modem identification. The status at the time can be verified in the result window during modem search (see next figure).

Examples:

Command	Functions
Sync	The signal can be processed
Ident	The modem has been identified but on condition that the production Automat accepts the signal quality.
Access	The modem has been identified clearly enough to omit the quality check.
Fail	The modem is not (no longer) available

Table 77: DDL Control Commands


Result display

No.	Name	Detection	QDet	QSig	QSR	Decod	DMM	SR	Shift
030	Pactor	none	0 %	–	–	no sync	No	–	-
031	Piccolo 6 50ms	none	35 %	6 %	0 %	no sync	No	19.7 Bd	-
032	Piccolo 12	impossible	–	–	–	–	No	–	-
033	Pol-Arq 100Bd/270Hz	modem	94 %	99 %	76 %	identified	No	100.1 Bd	271.5 H:
034	PSK31 (31.25 Bd)	none	38 %	13 %	0 %	–	No	30.8 Bd	-
035	PSK63 (62.5 Bd)	none	62 %	25 %	62 %	–	No	67.2 Bd	-
036	PSK125 (125 Bd)	none	37 %	8 %	4 %	no sync	No	125.1 Bd	-

Figure 145 Result Display on Calling the Command Ident

In some cases decoders require the processing of the incoming bit stream before saving it to the input buffer. These commands must be listed before the main section of the program.

Pre-processing Commands

Examples:

Command	Functions
PPInvert	Invert every input bit
PPDescramble	Execute a descrambling function for any specified polynomial
PPBitCodeBIPH	Reverse BIPH bit encoding
PPBitCodeNRZ	Reverse NRZ bit encoding
PPBitCodeManch	Reverse Manchester bit encoding
PPConvertIcon	Convert multi-order input symbols according to a table
PPSymbolBitReversal	Reverse bit order of a multi-order input symbol

Table 78: DDL Pre-Processing Commands

Recommendation: Use a simple, comparable and working decoder as a model and modify this decoder systematically.

Compile and Operate New Decoders

Start Compiler

Complete decoder descriptions are compiled via the icon on the editor toolbar or via the menu item *Compile / Install* on the *Edit* menu. The result is displayed in the pane below the edited text. Successful compilation is indicated by the message *0 Errors* in the final row. In this case, the executable decoder code has been created and is available for loading.

In case of incorrect source text, an error message will be shown which also indicates the row number in question. A mouse click on the error row indicated will automatically position the cursor in this row in the

text box. Any error messages at this point merely refer to incorrect syntax and the formal integrity of the program.

Figure 146 Message on Successful Compilation

The proper operation of a program, however, cannot be verified until the new decoder has been started. The new decoder code is displayed in the decoder selection list. The code has been previously saved to a file with the extension *.bin*. For initial testing, we recommend to start a manual production process with a suitable test signal.

Runtime errors may occur in this process. These errors will cause error messages, which are displayed in the column *Decod* in the result display. To obtain a detailed error message, activate the checkbox ☑ *XML Tag Filter* on the <*Extras*> tab of the result display.

Runtime errors are caused by errors that were impossible to detect in the compilation process. Such errors are e.g. inadmissible parameter values, exceeding of runtime due to endless loops, inappropriate input formats due to incorrect demodulators, or internal buffer overflow.

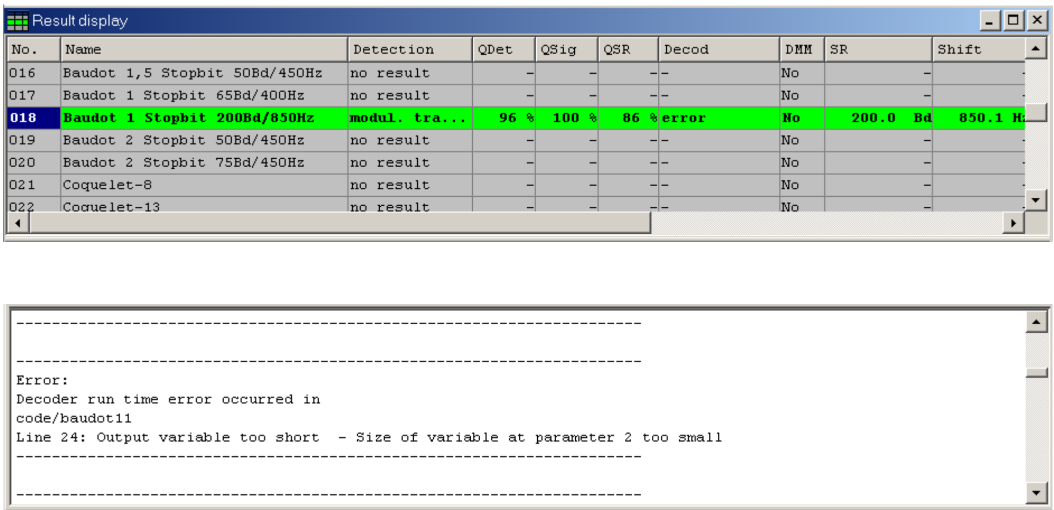


Figure 147 Display of Runtime Error

The row number indicated in the error message (here: Line 24) refers to the specific position in the source code where an inadmissible condition has been identified and the program has been aborted. You will find an example in chapter ANNEX 5 Examples.

Service

Support

In the event of further questions or problems during the test stage, please do not hesitate to contact PLATH AG at:

Phone +41 31 311 6446
Email **support@go2SIGNALS.ch**

After the test stage, i.e. during the regular use of the product, we shall provide support within the scope of the Service and Support Agreements concluded on the acquisition of this product.

Training

As a supplement to this documentation, PLATH AG offers comprehensive training e.g. in decoder creation, manual analysis and the enhancement of automated production.

For additional information on the above training options, please contact your local sales representative.

ANNEX 1 Port Configuration

Apply in detail for the port allocation of the go2DECODE applications with the following conventions:

Ports for the APC and SDA

Parameter	Default Value	Item
PortBase	41001	The Parameter PortBase will be used for the adjustment of the port
PortBase +0		Standard-IF-Data-Port: Data out of Signal Memory
PortBase +1		Port for order acceptance: Orders taking from SDA
PortBase +2		Port for order acceptance: Orders taking from SSS
PortBase +6		Port for Status information (SNMPServer)
PortBase +21		SDA-Control-Port

Table 79: APC and SDA Ports

Configuration by Configuration file:

```
<add key="PortBase" value="..." />
```

Configuration by Parameter Commands:

```
apc.exe PortBase=...
```

Ports for the DANA

Parameter	Default Value	Item
DataPortBase DataPortBase1	44000	The Parameter DataPortBase (or DataPortBase1) will be used for the adjustment of the port
DataPortBase +1		BBF-Port Dana

Table 80: DANA Ports

Configuration by Configuration file:

```
<add key="DataPortBase" value="..." />
```

Configuration by Parameter Commands:

```
dana.exe DataPortBase=...
```

Note: If you use *DataPortBase* as well as *DataPortBase1*, the value of *DataPortBase1* will always be used.

Ports for the SOMO

Parameter	Default Value	Item
DataPortBase1	44000	The Parameter DataPortBase1 will be used for the adjustment of the port
DataPortBase2	44200	The Parameter DataPortBase2 will be used for the adjustment of the port
DataPortBase1 +1		BBF-Port SOMO
DataPortBase2 +2		SBF-Port SOMO

Table 81: SOMO Ports

Configuration by Configuration file:

```
<add key="DataPortBase1" value="..." />
<add key="DataPortBase2" value="..." />
```

Configuration by Parameter Commands:

```
somo.exe DataPortBase1=... DataPortBase2=...
```

Note: If you use *DataPortBase* as well as *DataPortBase1*, the value of *DataPortBase1* will always be used.

ANNEX 2 Sound Configuration

Select Audio Output

To call the list of existing devices in order to view and select the desired sound device, open the dialog box *Sound Configuration* via the menu item *Extras – Sound Configuration…*

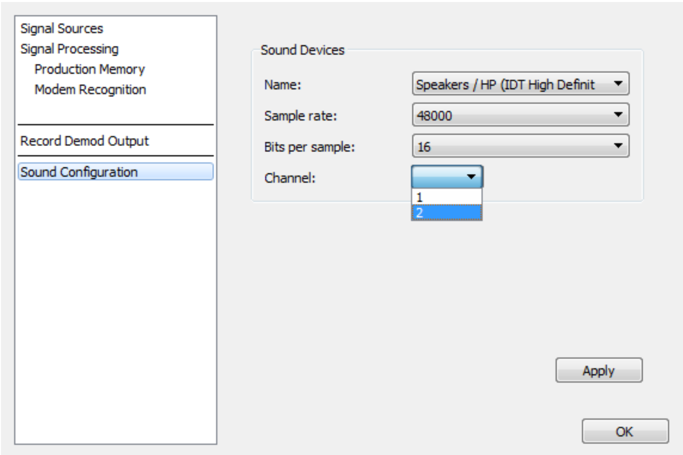


Figure 148 Sound Configuration Dialog Box

Parameter	Description
Name	Select the desired sound device from the list of available devices.
Sample Rate	Select the sampling rate of the selected sound card (provided the sound device supports the respective sampling rate). The following options are available:'
Bits per Sample	Set the resolution of the selected sound device:
Channel	Specify which sound card output (or input) is to be used for the output or input of data.

Table 82: Sound Configuration Parameters

Configure Multi-Channel Sound Device

The parameters of multi-IO sound devices are preset in an XML configuration file named *cardlist.xml.* This file, which is located in your directory *applications*, holds the configurations and descriptions of various sound cards, i.e. number of channels, sampling rates, internal names, etc so that the exact parameters of one's specific sound device can be preset. The configuration is assigned to the respective module by means of the sound card description.

Edit the file using an appropriate editor such as e.g. Microsoft® NotePad.
Should *cardlist.xml* not be found, the software will use the default values:

Parameter	Range	Description
Sampling Rate	96 000 Hz (Studio) 48 000 Hz (R-Dat) 44 100 Hz (CD) 32 000 Hz 24 000 Hz 22 050 Hz 16 000 Hz 11 025 Hz 8 000 Hz	Sampling rate setting of sound device (provided the sound device supports the respective sampling rate).
Bits per Sample	8 bits 16 bits (default) 24 bits 32 bits	Resolution of sound device
Number of channels	2	It is assumed the sound card is a stereo sound card.

Table 83: Multi Channel Sound Configuration Parameters

Configuration File cardlist.xml

This section describes the contents of the configuration file for sound devices and the respective tags. The values stored for each sound card are:

```
<card>
  <name>ensonic1371</name>
  <description>
    <desc>ENS1371 - Ensoniq AudioPCI</desc>
    <desc>Creative Sound Blaster-PCI</desc>
  </description>
  <channels>2</channels>
  <bitspersample>
    <bps>8</bps>
    <default>16</default>
  </bitspersample>
  <samplerate>
    <sr>12000</sr>
    <sr>24000</sr>
    <default>44800</default>
  </samplerate>
</card>
```

This table shows the admissible tags and their description:

Tag	Description
bitspersample	Defines the list box Bits per Sample of the sound device
bps	Individual item displayed in list box Bits per Sample
card	Configuration of one sound device
channels	Defines the number of channels of the respective sound device
default	Defines the default value for Sampling rate Bits per sample The value is also displayed as clickable parameter item in the list box.

Tag	Description
descriptions	Several device description entries are admissible enclosed by the tags <description> and </description>. Note: These description entries vary since the descriptions read out from the hardware or drivers will differ under Windows® and Linux®.
desc	Individual item displayed in list box Bits per Sample
name	Internal name (the name must not include the characters dot, space or underscore)
samplerates	Defines the list box Sample Rate of the sound device
sr	Individual item displayed in list box Sample Rate

Table 84: Sound Device Configuration Tags

Configuration Example

```
<cardlist>
        <card>
                <name>ensonic1371</name>
                <descriptions>
                        <desc>Ensonic AudioPCI</desc>
                        <desc>ens1371 - AudioPCI</desc>
                </descriptions>
                <channels>2</channels>
                <bitspersample>
                        <bps>8</bps>
                        <bps>16</bps>
                        <default>32</default>
                </bitspersample>
                <samplerates>
                        <sr>12000</sr>
                        <sr>24000</sr>
                        <default>44800</default>
                </samplerates>
        </card>
        <card>
                <name>audigy2nx</name>
                <descriptions>
                        <desc>SB Audigy 2 NX</desc>
                        <desc>USB Audio - SB Audigy 2 NX
</desc>
                </descriptions>
                <channels>4</channels>
                <bitspersample>
                        <bps>8</bps>
                        <default>16</default>
                        <bps>32</bps>
                </bitspersample>
                <samplerates>
                        <sr>12000</sr>
                        <sr>24000</sr>
                        <default>44100</default>
                        <sr>48000</sr>
                </samplerates>
        </card>
</cardlist>
```

Figure 149 Configuration Example

ANNEX 3 Demodulator Parameters

Various parameters are available for every demodulator type. Some demodulators allow for changes in their symbol tables, i.e. modification of the symbol values produced by the demodulator in question.

Demodulator Parameters:

	Voice	ASK 2	Morse	F1A	F6 / F7B	FSK 2 matched	FSK 2, 3, 4 discr.	FSK 2, 3 autoshift	Multitone (MFSK)	Multichannel FSK2	(G)MSK	TFM3	DPSK 2, 4, 8, 16 A/B	PSK 2, 4, 8, 16 A/B	PSK data aided	MDPSK 2, 4, 8, 16	MPSK 2, 4, 8, 16 A/B	OQPSK	ASK2PSK8	ASK4PSK8	QAM 16	QAMn	OFDM	Analogue Selcall	Clover II / 2000 / 2500	Coquelet	Pactor II / III
Adaptive Equalizer											●	●	●	●		●	●		●	●	●	●			●		●
Audio in file	●		●																								
BT											●																
Burst mode					●	●	●	●	●	●	●		●	●	●	●	●						●	●	●	●	
Channel1 abs. phase																							●				
Channel1 diff. phase																							●				
Channel distance										●						●	●						●				
Channel position type										●						●	●										
Code																					●	●					
Constellation																							●				
Distance F1 <-> F2					●																						
Distance F2 <-> F3					●																						
Distance F3 <-> F4					●																						
F7B mode					●																						
Filters							●			●			●	●		●	●	●				●					

	Voice	ASK 2	Morse	F1A	F6 / F7B	FSK 2 matched	FSK 2, 3, 4 discr.	FSK 2, 3 autoshift	Multitone (MFSK)	Multichannel FSK2	(G)MSK	TFM3	DPSK 2, 4, 8, 16 A/B	PSK 2, 4, 8, 16 A/B	PSK data aided	MDPSK 2, 4, 8, 16	MPSK 2, 4, 8, 16 A/B	OQPSK	ASK2PSK8	ASK4PSK8	QAM 16	QAMn	OFDM	Analogue Selcall	Clover II / 2000 / 2500	Coquelet	Pactor II / III
Frequency table									●	●						●	●							●			
Increment abs. phase																							●				
Increment diff. phase																							●				
Keying rate			●	●																							
Tolerance			●	●																							
Max. burst length					●	●	●	●	●	●	●		●	●	●	●	●						●	●	●	●	●
Min. burst length					●	●	●	●	●	●	●		●	●	●	●	●						●	●	●	●	●
Min. burst SNR													●	●		●	●						●	●	●		●
Min. pause length					●	●	●	●	●	●	●		●	●	●	●	●						●	●	●	●	●
Modulation order							●	●					●	●	●	●	●					●			●		
Modem type						●	●	●																			
No. of channels										●						●	●						●				
No. of tones									●															●		●	
Range			●	●																							
SELCAL type	●																							●			
Sensitivity	●																										
Shift				●		●	●	●		●					●												
Tolerance				●		●	●	●		●					●												
Special channels																							●				
Symbol rate		●			●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●				
Tolerance		●			●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●					
Symbol table		●		●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●					
Tone distance									●	●																●	
Tone duration									●	●														●		●	
Tolerance									●	●														●		●	
Tone position type									●	●																	
Type											●																
Use XML																							●				
Version													●	●		●	●										
Voice mode	●																										
XML																							●				

Table 85: Demodulator Parameter Combinations with Signal Types

The following table provides a detailed description of the parameters:

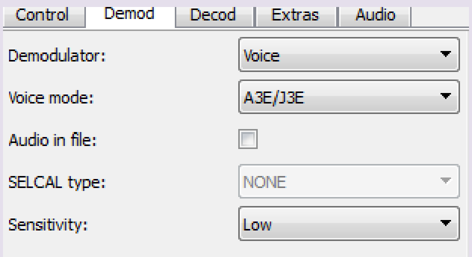
Parameter	Function
Adaptive equalizer	These parameters serve to switch the LMS transmission-channel equalization on and off. This compensates distortions that occur during transmission. LMS (Least Mean Squares) is the applied equalizing algorithm.
Audio in file	Activate the recording of *.wav* files by means of these parameters. This requires saving the active IF. If this function records the signal, a .wav file is recorded simultaneously.
BT	This is the product of -3dB bandwidth and symbol duration, and is a specific characteristic of GMSK. Typical values are e.g. 0.25 for Tetrapol, 0.3 for GSM, and 0.5 for DECT.
<Burst mode>	This parameter serves to switch the burst mode on or off. The following three parameters are only available in burst mode. Bursted signals only exist within a period defined by means of the burst length. Between such periods, they have a pause defined by means of the pause length.
Channel1 abs. phase	Defines the absolute phase of channel 1 in mode OFDM.
Channel1 diff. phase	Defines the differential phase of channel 1 in mode OFDM.
Channel distance	Defines the distance between the individual channels.
Channel position type	Choose between the lists items Channel distance and Channel frequencies.
Code	Displays the QAM encoding type adjusted (V22 or V17 or V32).
Constellation	Absolute/differential phase constellation for OFDM channels.
Distance F1 <-> F2	Defines the distance between frequency 1 and frequency 2 of an F6/F7B modem.
Distance F2 <-> F3	Defines the distance between frequency 2 and frequency 3 of an f6/F7B modem.
Distance F3 <-> F4	Defines the distance between frequency 3 and frequency 4 of an F6/F7B modem.
F7B mode	Mode of F6/F7B, i.e. content of left and right channel (Data / Data, Data / Morse, Morse / Data, Morse / Morse, Data / -, - / Data, Morse / -, - / Morse, Data (interleaved)).
<Filters>	Invokes dialog to define individual window function and filter parameters.
<Frequency table…>	Provided the selected list item in the drop-down list box Channel position type is Channel frequencies, activation of this button will display a table for input of the desired frequency for each channel. Using the button <**Init**> in this table, the frequency can be initialized at equidistant intervals based on the current entries in Channel distance and No. of channels. Manual editing is possible via double click on the respective cell. Subsequently, the various frequencies from this table will be used. The setting procedure for the parameter Tone position type is identical.
Increment abs. phase	Defines the increment of the absolute phase in mode OFDM.
Increment diff. phase	Defines the increment of the differential phase in mode OFDM.
Keying rate (Channel A/B)	Defines the transmission rate (Bpm). This is the number of characters produced per minute.
Keying rate tolerance	Defines the admissible inaccuracies in the transmission rate (Bpm).
Max. burst length	Defines the maximum time the signal exists in burst mode (s).
Min. burst length	Defines the minimum time the signal exists in burst mode (s).
Min. pause length	Defines the minimum pause length between two signals in burst mode (s)

Parameter	Function
Modulation order	Defines the number of potential bit counts of a symbol (2-order 1 bit, 4-order 2 bits, etc.). One bit is the lowest transmissible binary unit of information. It can have the values 0 and 1.
Modem type	Defines the mode of FSK demodulation, namely: Synchronous: If there are no or hardly no symbols that occur as single symbols but only as double, triple, etc. ones, the symbol rate quality will deteriorate to 0 permanently to indicate that there is a demodulation with a multiple of the actual symbol rate. Asynchronous: Support of half start/stop bits. Multi SR: Multiple symbol rates. The symbol rate quality will not deteriorate if the demodulation is made with a multiple of the actual symbol rate. Oversampling 2x, 4x, etc.: Multiple sampling during a symbol duration. Note that the symbol quality may deteriorate. Heavily interfered signals may require to set the symbol rate tolerance to 0 to prevent the symbol rate from drifting off.
No. of channels	Defines the number of channels
No. of tones	Displays the adjusted number of tones
Range	Indicates the transmission range setting (BpM): 20..500 20..30 30..60 60..125 125..250 250..500 Fixed: This setting serves to set the transmission rate with tolerance.
SELCAL type	Defines the type of the SELCAL data
Sensitivity	Defines the voice sensitivity: Low (not sensitive) Medium (sensitive) High (very sensitive) For a well-balanced detection and misdetection ratio, we recommend to set this parameter to Medium by default.
Shift	Defines the interval between lowest and highest frequency (Hz) in an FSK modem
Shift tolerance	With this parameter the admissible inaccuracies in the shift (Hz) can be modified. Note that the software may reduce the shift tolerance value entered to an appropriate value for the de-modulator used. Exception with FSK2 matched: When using the demodulator FSK2 matched, and provided the search is carried out with the Automat, nominal frequency or search range, note that the shift will, in addition to the de-modulator measurement, be measured automatically if the tolerance value entered is greater than half the shift value or greater than 1.2 * symbol rate. The measuring result is sent to the demodulator.
Special channels	Number of special channels
<Special channels…>	Provided at least one special channel has been entered, activating this this button will display a table for input of the type and the special characteristics of the respective channel: Channel Number: Channel number in the channel grid (manual editing is possible), values less than 1 and greater than the parameter No. of channels are possible. Type: Type of pilot tone or constellation, respectively Phase [deg]: (only with pilot tones) Reference phase at sampling time

Parameter	Function
	Gain [dB]: Gain or attenuation factor
Symbol rate (Channel A/B)	Displays the symbol rate setting (Bd: symbols/second). The symbol rate is the transmission rate of the signal.
Symbol rate tolerance	With this parameter, change the admissible inaccuracies in the symbol rate. Note that the software may reduce the symbol rate tolerance value entered to an appropriate value for the demodulator used.
<Symbol table…>	Serves to display and edit the symbol table. This parameter defines the bit number of the symbol. The physical limit condition for the bit number, which can be set in the right part of the symbol table, is specified in the left part of the symbol table.
Tone distance	Defines the intervals between the individual tones (Hz).
Tone duration	Sets the preset duration of a tone in the multi-tone demodulator.
Tone duration tolerance	Defines the admissible inaccuracies in the tone duration (ms). Note that the software may re-duce the shift tolerance value entered to an appropriate value for the demodulator used.
Tone position type	Choose between the list items Tone distance and Tone frequencies.
Type	Select type MSK or GMSK
<Use XML>	Activates/deactivates the control of certain OFDM parameters by XML scripts.
Version	Displays the adjusted PSK version A or B. In PSK, the bit values are encoded by the shift be-tween phase angles of the signal (the angles depend on the modulation order). In version B, the number of shifts is doubled. Version B allows for an easier recovery of the symbol rate from the signal.
Voice Mode	The voice mode specifies the modulation types to be detected by the speech modem. The software can search for single modulation types or combinations thereof. In the drop-down list box select from the following parameters: A3E_J3E One and two side band A3E Two side band amplitude modulation with carrier J3E One side band modulation without carrier J3E_USB One side band: Upper side band J3E_LSB One side band: Lower side band F3E Frequency modulation Once the software detects the voice modulation type to search, the result is indicated in the Result Display and a recording is made provided the check box ☑ Audio in file is selected. Should the software detect any voice modulation types that do not correspond to the type to search for, the Result Display treats the respective modem as if nothing had been detected.
<XML …>	Invokes dialog to load and/or modify XML parameter file used in mode OFDM.

Table 86: Demodulator Parameter Functions

The applied parameters of every demodulator are depicted in the following table:

Demodulator	Additional Settings
Voice (Speech)	 *Figure 150 Voice Parameters*

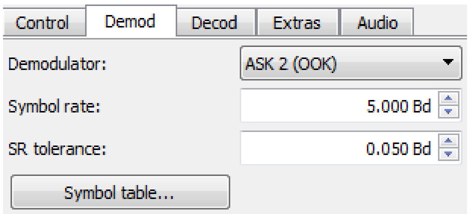
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>ASK2 (OOK)
(Amplitude Shift Keying,
2-order amplitude shift
keying</td><td>

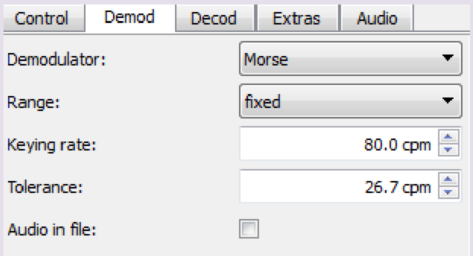
Figure 151 ASK2 Parameters</td></tr>
<tr><td>Morse</td><td>

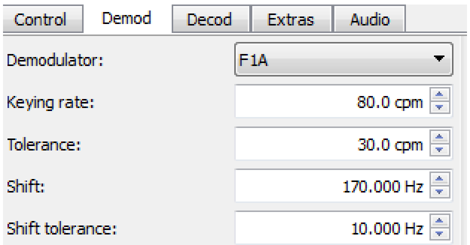
Figure 152 Morse Parameters</td></tr>
<tr><td>F1A</td><td>

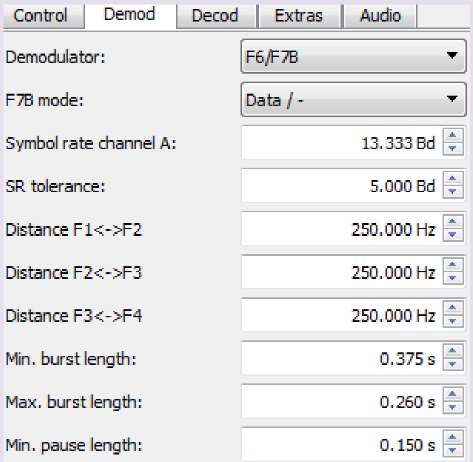
Figure 153 F1A Parameters</td></tr>
<tr><td>F6/F7B</td><td>

Figure 154 F6/F7B Parameters</td></tr>
</table>

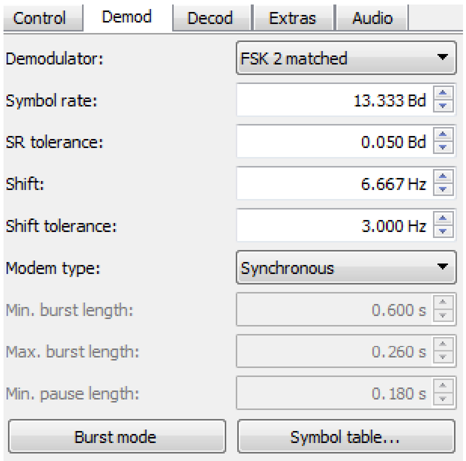
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>FSK 2 matched
(Frequency Shift Keying,
2-order frequency shift keying with matched filter demodulator, modulation index > 1)</td><td>


Figure 155 FSK2 matched Parameters

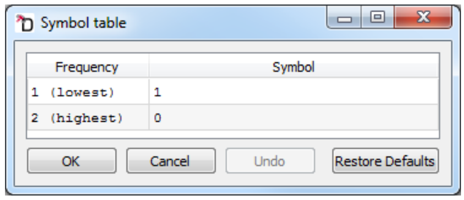


Figure 156 Frequency to Symbol Conversion Table

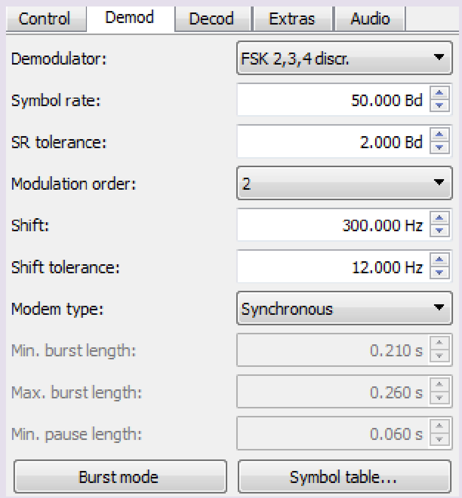
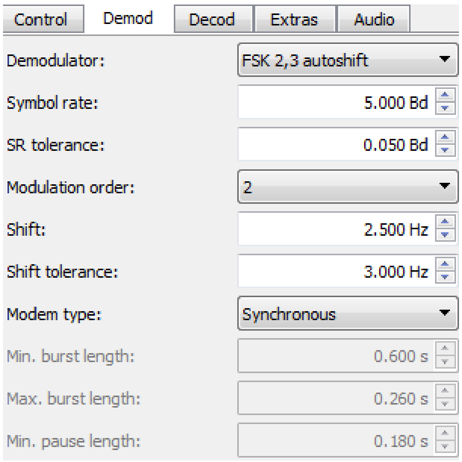
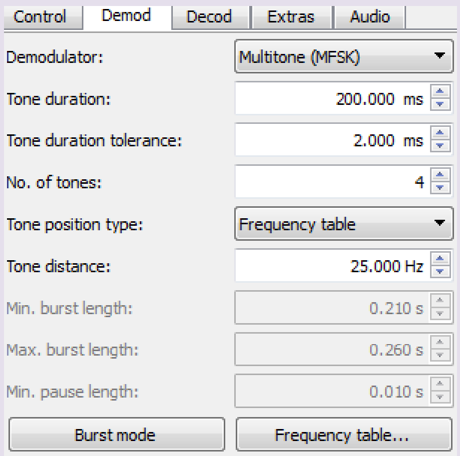
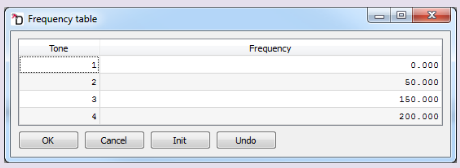
Note : Similar tables are available with all FSK modems.
</td></tr>
<tr><td>FSK 2, 3, 4 discr.
(Frequency Shift Keying, 2-order, 3-order, or 4-order frequency shift keying with discriminator, FM demodulation, modulation index 0.5 … 1)</td><td>


Figure 157 FSK 2, 3, 4 discr. Parameters
</td></tr>
</table>

Demodulator	Additional Settings
FSK 2, 3 autoshift	 *Figure 158 FSK 2, 3 autoshift Parameters*
Multitone (MFSK)	 *Figure 159 Multitone (MFSK) Parameters*  *Figure 160 Frequency Table for Multitone Modems* Note : Similar tables are available with all multitone modems.

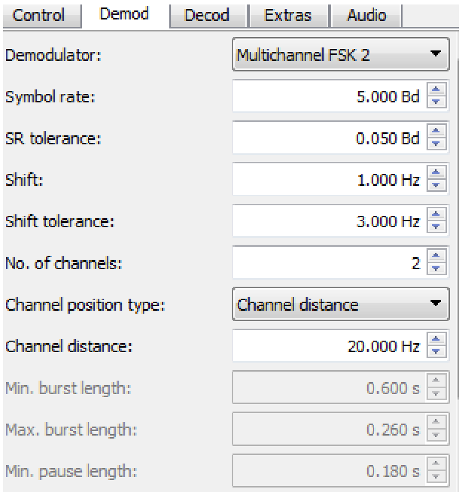
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>Multichannel FSK 2</td><td>


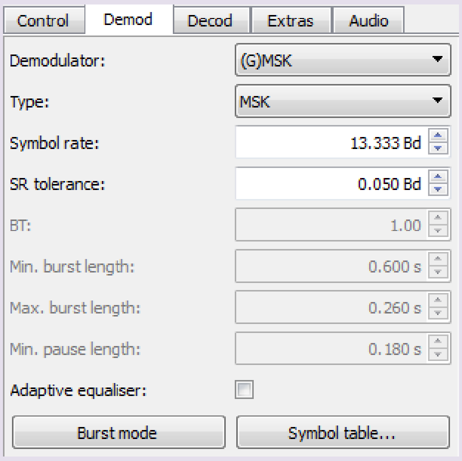
Figure 161 Multichannel FSK 2 Parameters
</td></tr>
<tr><td>(G)MSK
(Gauss Windowed) Minimum Shift Keying, bivalent frequency shift keying with minimum shift, modulation index = 0.5)</td><td>


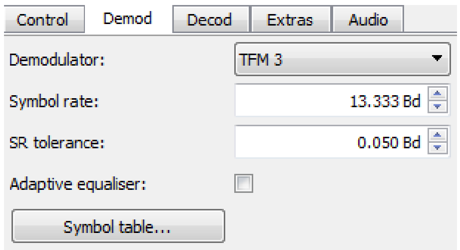
Figure 162 (G)MSK Parameters
</td></tr>
<tr><td>TFM 3</td><td>


Figure 163 TFM 3 Parameters
</td></tr>
</table>

Demodulator	Additional Settings
DPSK 2, 4, 8, 16 A/B (Differential Phase Shift Keying)	

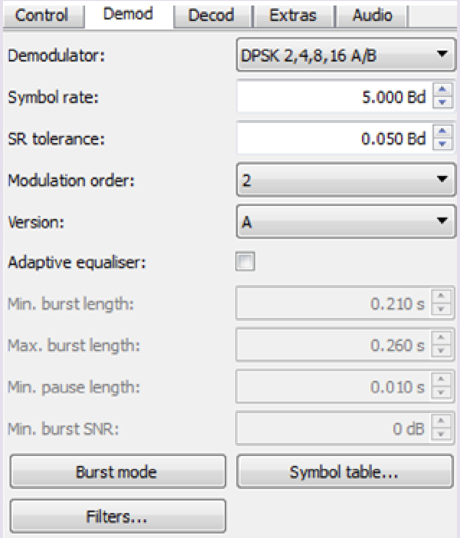


Figure 164 DPSK 2,4,8,16 A/B Parameters

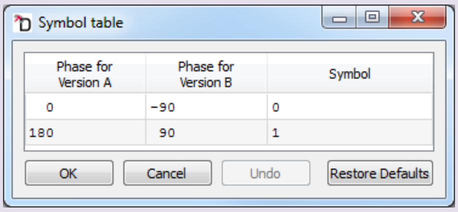


Figure 165 Phase to Symbol Conversion Table

Note : Similar tables are available with all PSK modems.

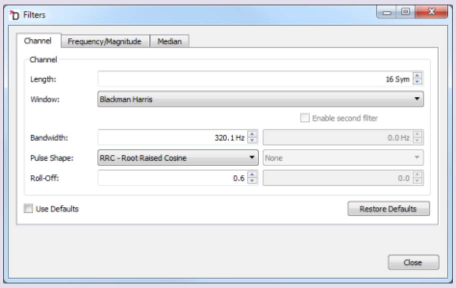


Figure 166 PSK Channel Filter Parameters

Note : This dialog is available with all PSK modems.

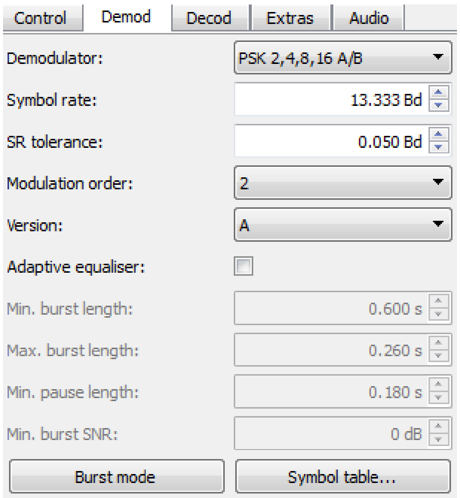
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>PSK 2, 4, 8, 16 A/B
(Phase Shift Keying, absolute phase shift keying)</td><td>

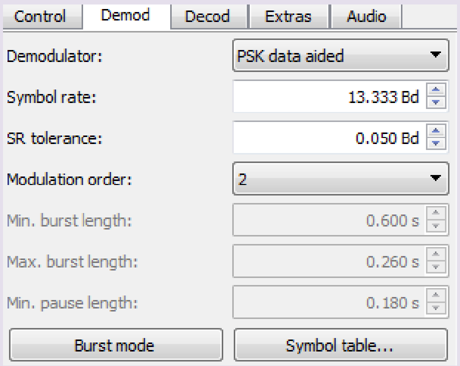
Figure 167 PSK 2,4,8,16 A/B Parameters</td></tr>
<tr><td>PSK data aided</td><td>

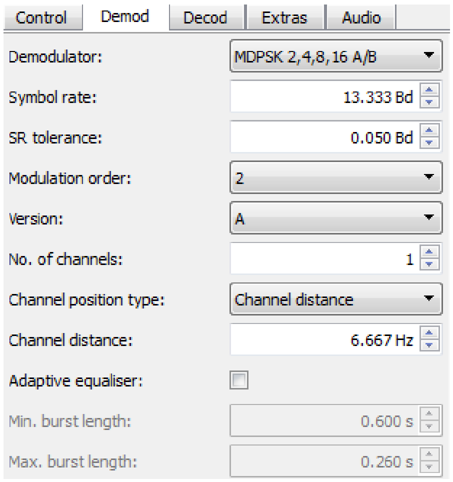
Figure 168 PSK data aided Parameters</td></tr>
<tr><td>MDPSK 2, 4, 8, 16 A/B
(Multi-DPSK, 2-, 4-, 8- or 16-order multi-channel differential phase shift keying, 2 - 100 channels)</td><td>

Figure 169 MDSPK 2,4 A/B Parameters</td></tr>
</table>

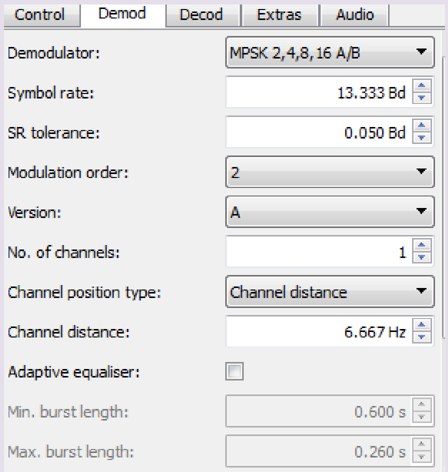
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>MPSK 2, 4, 8, 16 A/B
(Multi-PSK, 2-, 4-, 8- or 16-order multi-channel absolute phase shift keying)</td><td>

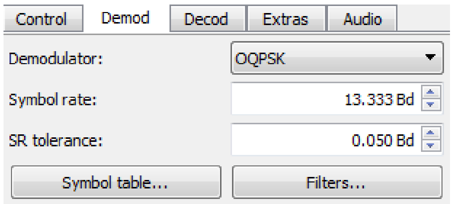
Figure 170 MSPK 2,4,8 A/B Parameters</td></tr>
<tr><td>OQPSK
(Offset Quadrature Phase Shift Keying)</td><td>

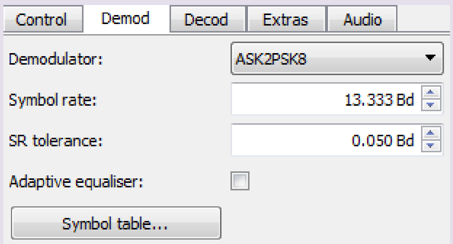
Figure 171 OQPSK Parameters</td></tr>
<tr><td>ASK2PSK8
(Quadrature Amplitude Modulation, same parameters as with ASK4PSK8)</td><td>

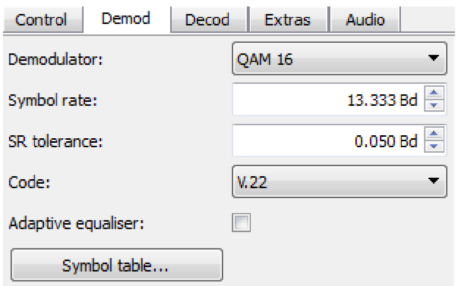
Figure 172 ASK2PSK8 /ASK4PSK8 Parameters</td></tr>
<tr><td>QAM 16
(Quadrature Amplitude Modulation, 16valent quadrature amplitude modulation)</td><td>

Figure 173 QAM 16 Parameters</td></tr>
</table>

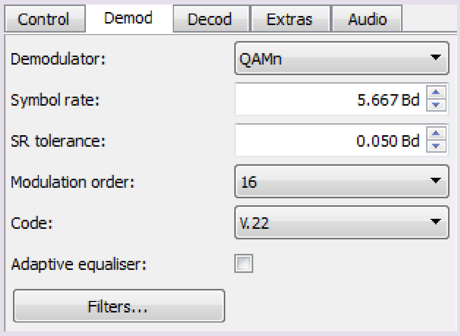
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>QAM n</td><td>


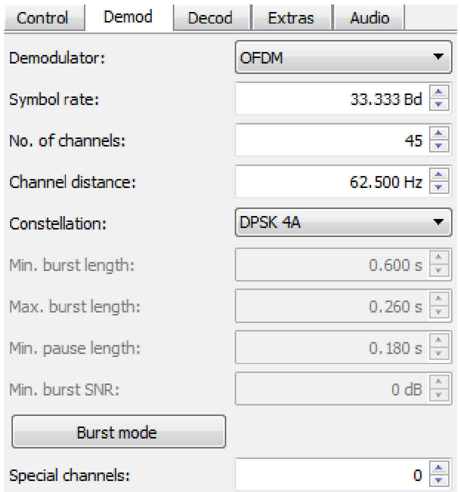
Figure 174 QAM n Parameters
</td></tr>
<tr><td>OFDM
(Orthogonal Frequency Division Multiplexed signal)</td><td>


Figure 175 OFDM Parameters

Note : An XML editor has been added so that the parameters of the OFDM demodulator can be edited. XML files created with the PROCITED Matlab OFDM Analysis Tool can be imported.

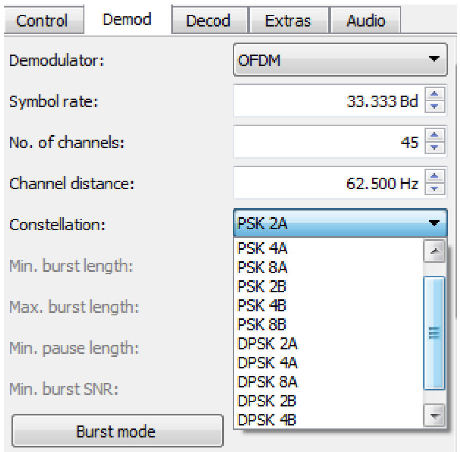


Figure 176 OFDM Constellations
</td></tr>
</table>

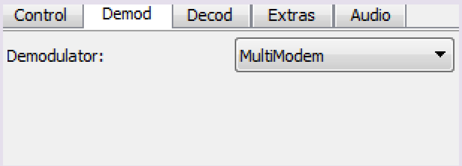
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>MultiModem
Continuous production across multiple (sub)modems</td><td>


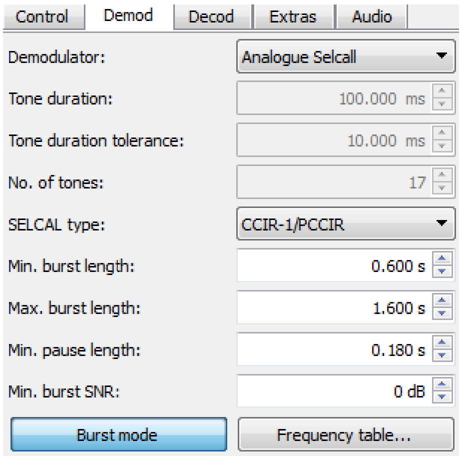
Figure 177 MultiModem</td></tr>
<tr><td>Analogue Selcall</td><td>


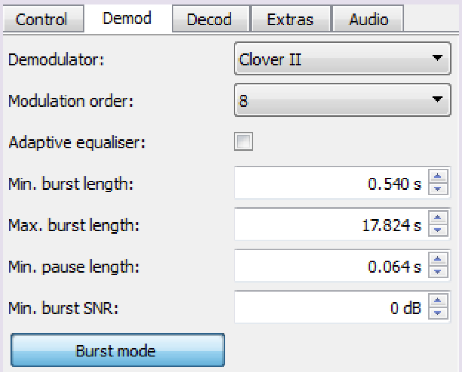
Figure 178 Analogue Selcall Parameters</td></tr>
<tr><td>Clover II</td><td>


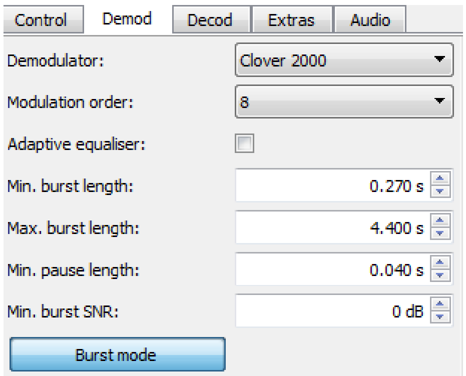
Figure 179 Clover II Parameters</td></tr>
<tr><td>Clover 2000</td><td>


Figure 180 Clover 2000 Parameters</td></tr>
</table>

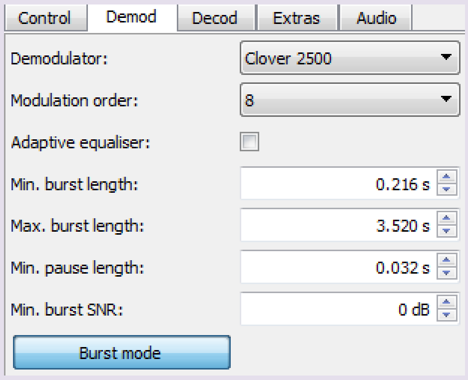
<table>
<tr><th>Demodulator</th><th>Additional Settings</th></tr>
<tr><td>Clover 2500</td><td>

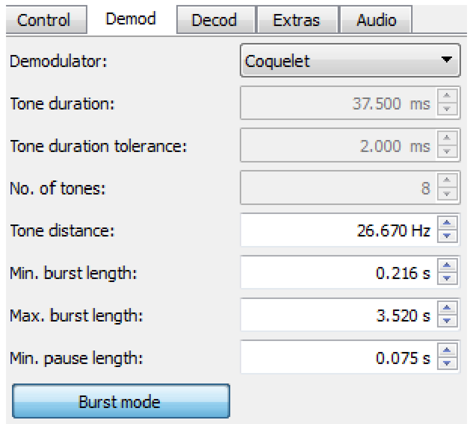
Figure 181 Clover 2500 Parameters</td></tr>
<tr><td>Coquelet
(Special filter demodulator for Coquelet signals)</td><td>

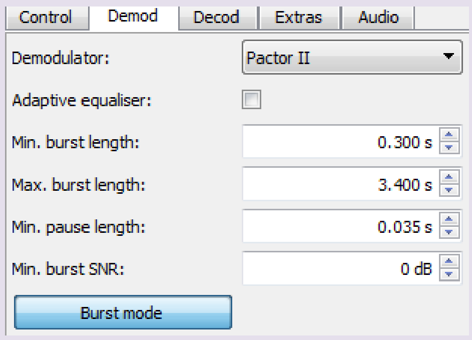
Figure 182 Coquelet Parameters</td></tr>
<tr><td>Pactor II/III</td><td>

Figure 183 Pactor II/III Parameters</td></tr>
</table>

Table 87: Demodulator Settings

Note: A modem plugin mechanism has been added to the APC. This decoder-interface can be used to integrate demodulators which have been developed by the customer and which he will not distribute. For more information please contact info@procitec.de.

ANNEX 4 Receiver Support

During the installation process of go2DECODE you can install three additional components as an option. For detailed information, please refer to the Installation Instructions. The first two components support the integration of two types of receivers, i.e. a Rohde & Schwarz ESMB receiver and receivers from the IZT R3000 family. The third option supports external hardware modems for content production within the go2DECODE environment.

Using Rohde & Schwarz ESMB Receivers

go2DECODE can immediately analyze data obtained from R&S ESMB monitoring receivers. The monitoring receiver uses an R&S DX200 to transfer the data via LAN interface.

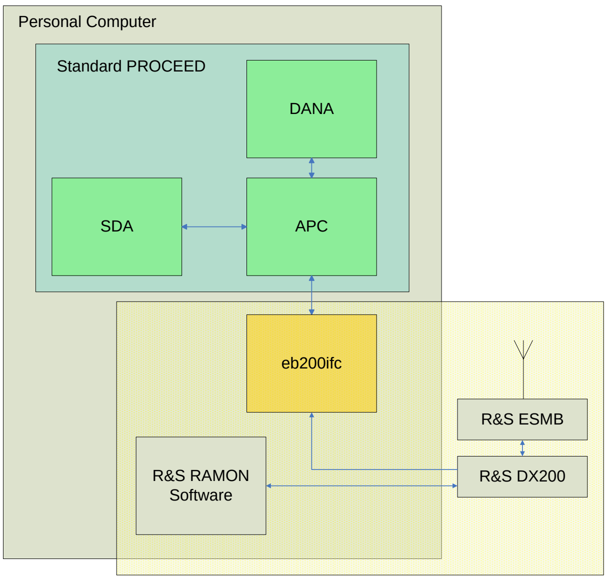


Figure 184 go2DECODE with R&S Receiver Connection

The R&S receiver is configured either manually by a simple telnet program or automatically by the R&S RAMON software, sending the data to the module eb200ifc. This module receives the data from the R&S receiver in UDP format and converts it into the format required by the APC. The interface between the R&S DX200 and the eb200ifc is based on the datagram communication protocol as described in Annex F of the manual describing the HF digital wideband receiver R&S EM510. For detailed information on how to connect the receiver to the personal computer, please refer to the corresponding user manual.

For correct manual configuration of the receiving equipment, send the following commands to the DX200 by telnet. In this example, we shall assume that the IP address of the host PC is 89.10.11.24:

```
sense:dem iq
trac:udp:tag "89.10.11.24", 48001, IF
trac:udp:flag "89.10.11.24", 48001, "SWAP", "OPT"
Band 50000
```

To check the settings, use: trac:udp?

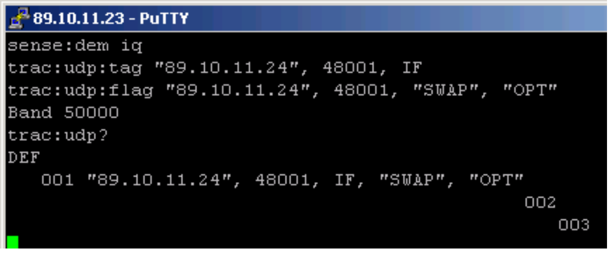


Figure 185 Configuration Check

To start the data transmission, enter the command *syst:if:rem:mode long*

Using Receivers of the IZT R3000 Family

Go2DECODE supports the operation of receivers of the IZT R3000 family. The following block diagram shows the components of go2DECODE with all additional components. The additional component to install is the receiver control module (RCM. This module receives the data from the IZT receiver in UDP format and converts the data into the format required by the APC).

The application IZT R3000 is the official software of IZT, serving to control the receiver manually. It is not provided with the go2DECODE software package and therefore not described in this manual. Please refer to the corresponding user manual for more information on how to connect the receiver to the personal computer.

The receiver transfers its data via the IZT control software to the computer where go2DECODE is running. All applications can be installed on one personal computer as depicted in the figure above, or on different machines. The default port number for a single channel is 8615. This value is specified during the installation procedure of go2DECODE. For receivers featuring several channels, specific channels can be selected by the proper port numbers (8625 for channel 2, 8635 for channel 3, …).

For trouble-free data transfer, execute the IZT control software as follows:

r3000.exe --automation_interface --c1-ip=localhost

When using another channel, modify the parameter --*c1-ip* accordingly (--*c2-ip,* --*c3-ip, …).*

Please observe the manufacturer's instructions and restrictions when operating the IZT receiver and control software.

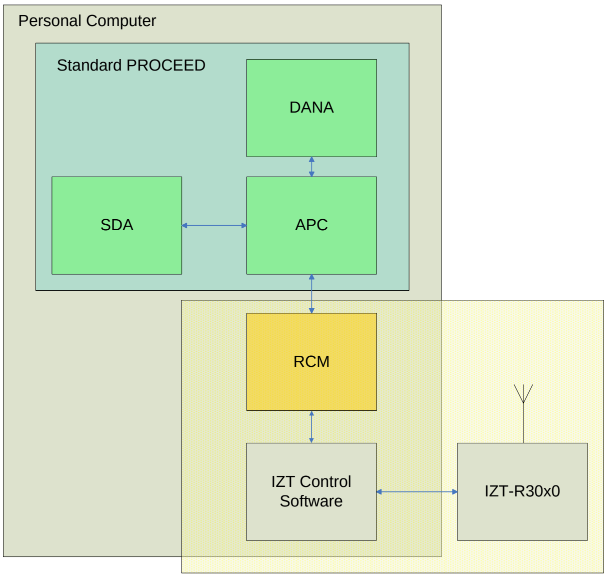


Figure 186 go2DECODE with IZT Receiver Connection

ANNEX 5 Examples

Select **<Programs> <go2SIGNALS> <go2DECODE> <DEMO>** in the WINDOWS 7 program group of the start menu to start DEMO Mode.

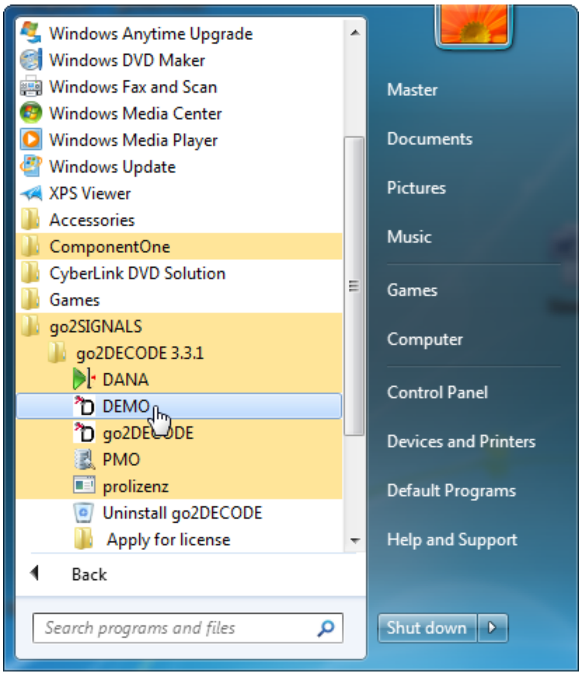


Figure 187 Select Demo Mode

SDA in the DEMO Mode

On start of go2DECODE DEMO, the SDA will appear as in the screenshot below. You will see a spectrum/sonagram display, a result display, the menu bar, the toolbar, two property sheets, and the status bar. DANA starts at the same time.

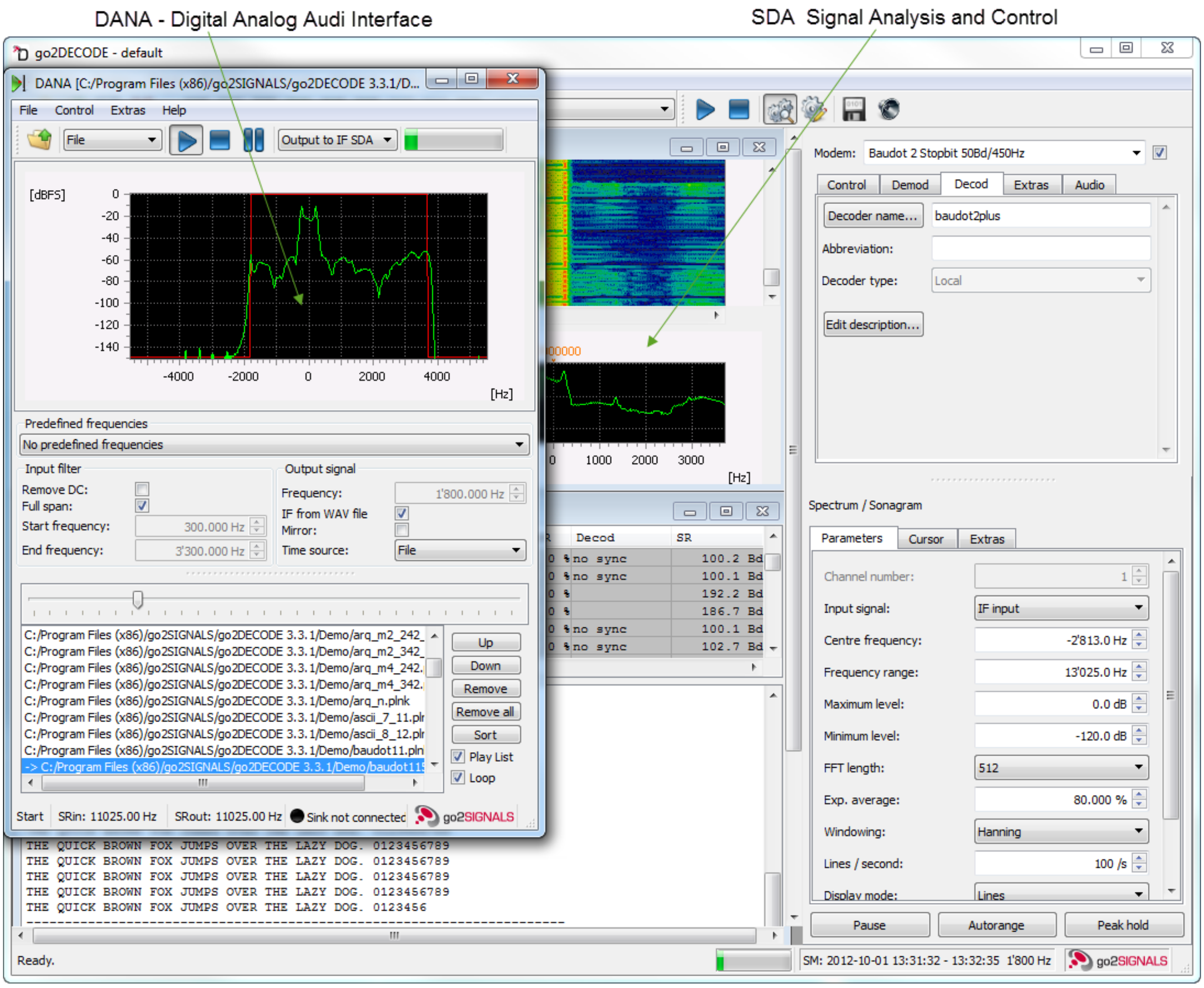


Figure 188 DANA, SDA (and APC) with Signals from .wav Files

Calling go2DECODE DEMO will start three applications. Use the options specific to your operating system to switch from one application to the other:

DANA: Filtering and conversion of the input signal into digital IF

APC: Automatic recognition of modems whose parameters have been previously entered into the knowledge base

SDA: Result display for APC and user interface for monitoring and manual analysis of the digital IF.

On the next pages you will find 2 examples.

Example 1 Morse Signal by SOMO (subject to the delivered version)

A Morse signal with a centre frequency of 4500 Hz is generated and played using the software modulation generator SOMO.

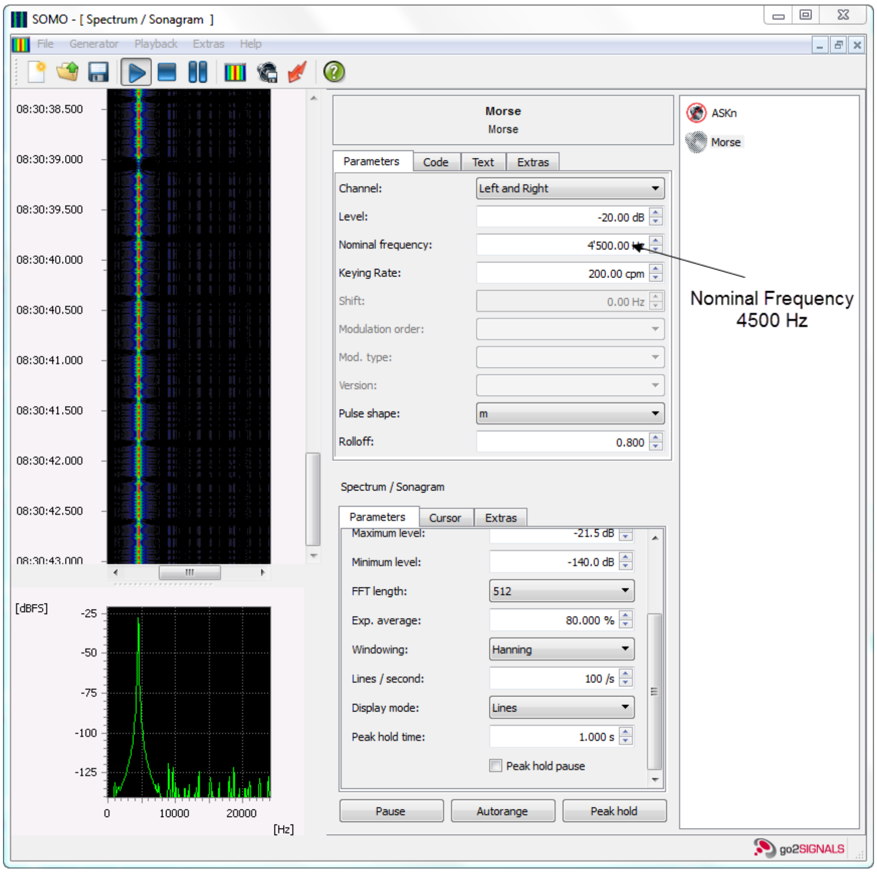


Figure 189 Signal Generation Using SOMO

This input signal is then filtered from 4,000 Hz to 5,000 Hz and shifted by 4,500 Hz using DANA.

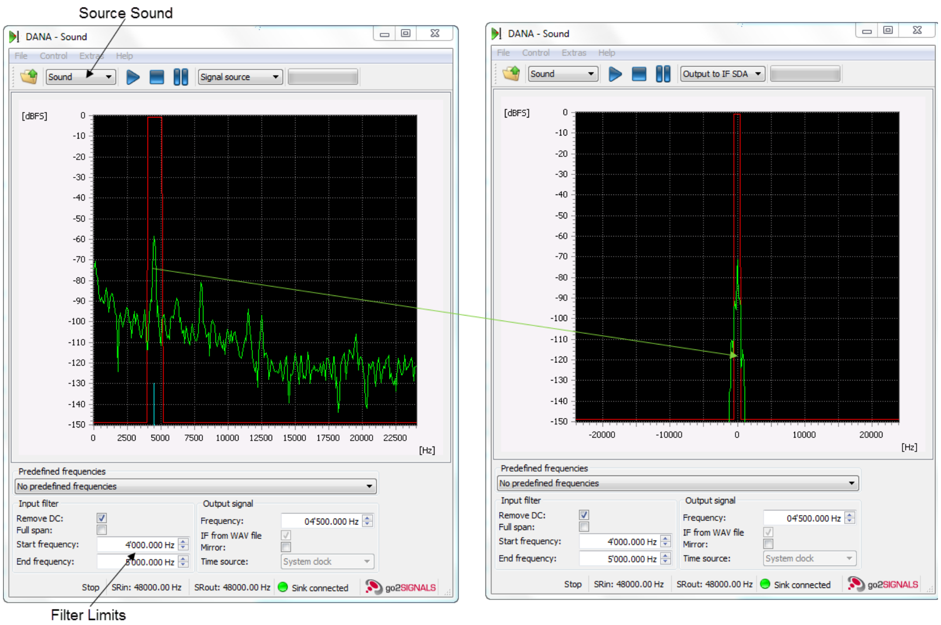


Figure 190 Input Signal in DANA with Filter Range 3-6 kHz and Output Shift

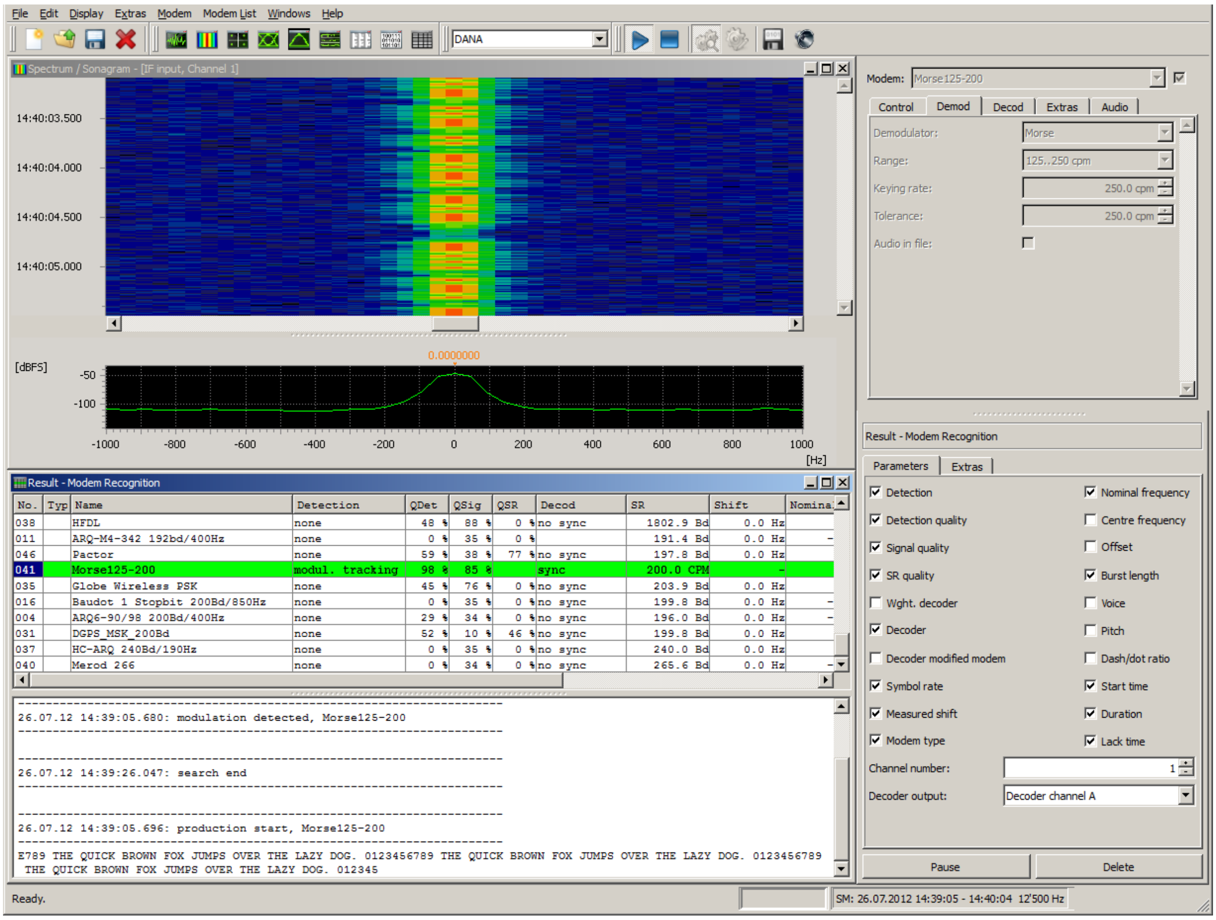


Figure 191 Signal in SDA Processed by APC

Example 2

A **USB speech signal** is played and processed directly by DANA. In this example, the signal is not filtered, but it is shifted by 4800 Hz:

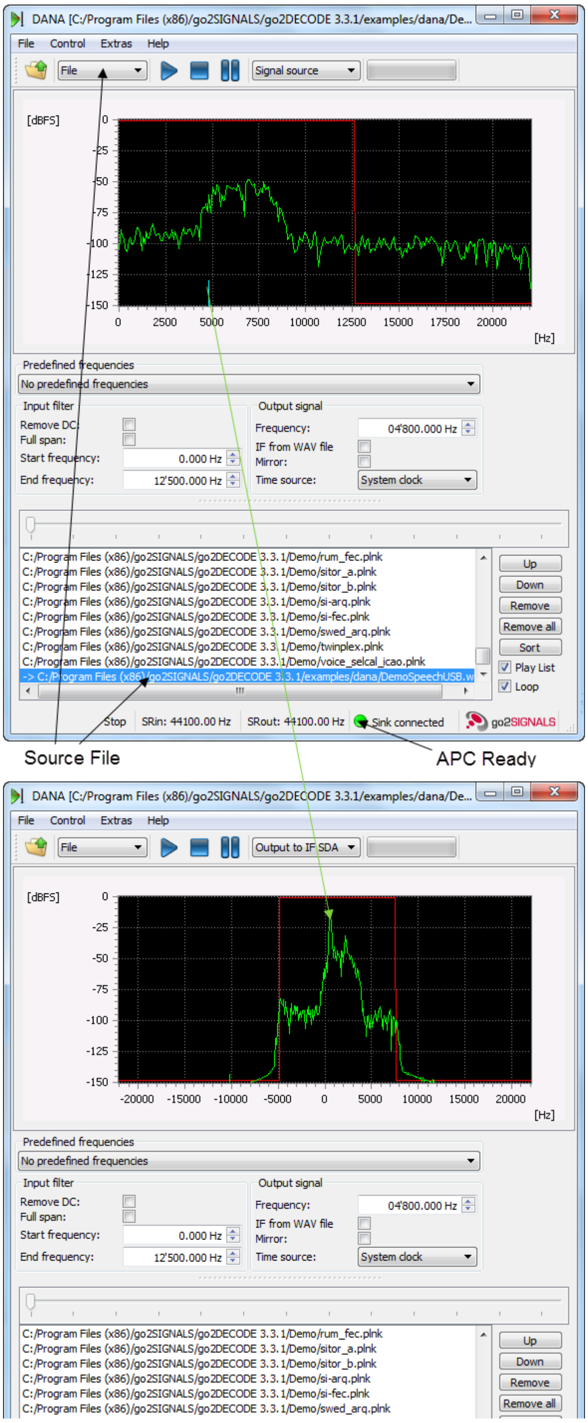


Figure 192 Input & Output Signal in DANA

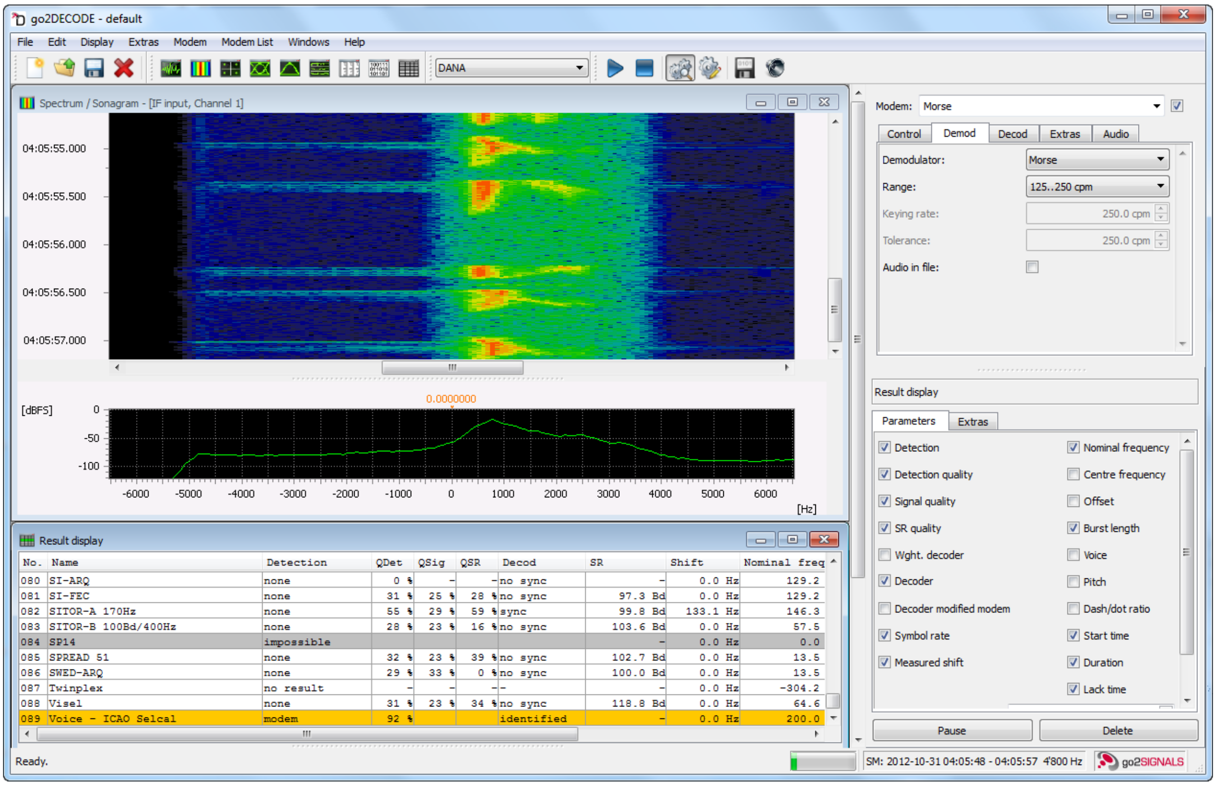


Figure 193 Speech Signals in SDA Processed by APC

Generating Signals Using SOMO

SOMO stands for *Software Modulation Signal Generator*. SOMO can generate a multitude of differently modulated signals.

These signals can be used e.g. as input signals for DANA, to establish a comprehensive test scenario for go2DECODE in a very short period of time.

Generating Signals

Several signals can be generated and played back individually or in combination. Select the desired signal type on the *Generator* menu, e.g. *Morse*. This signal is then displayed in the *List of Generators.* A generator highlighted, i.e. selected, in this list can be edited via the parameter window. To activate or deactivate the generator, double click the icon or the speaker icon .

All activated signals are calculated and generated or stopped and paused, using the buttons <**Start**>, <**Stop**> and <**Pause**> on the *Control* menu or the icons on the toolbar.

Transferring the Signal to APC using DANA

To ensure a correct signal processing in the APC, be sure to set the source to *Sound* in DANA and observe the nominal frequency adjusted in SOMO.

If the nominal frequency in SOMO has not been changed, either select the default setting for SOMO in DANA or enter the *Nominal frequency* adjusted in SOMO in DANA in the box *Frequency* as well.

Example:

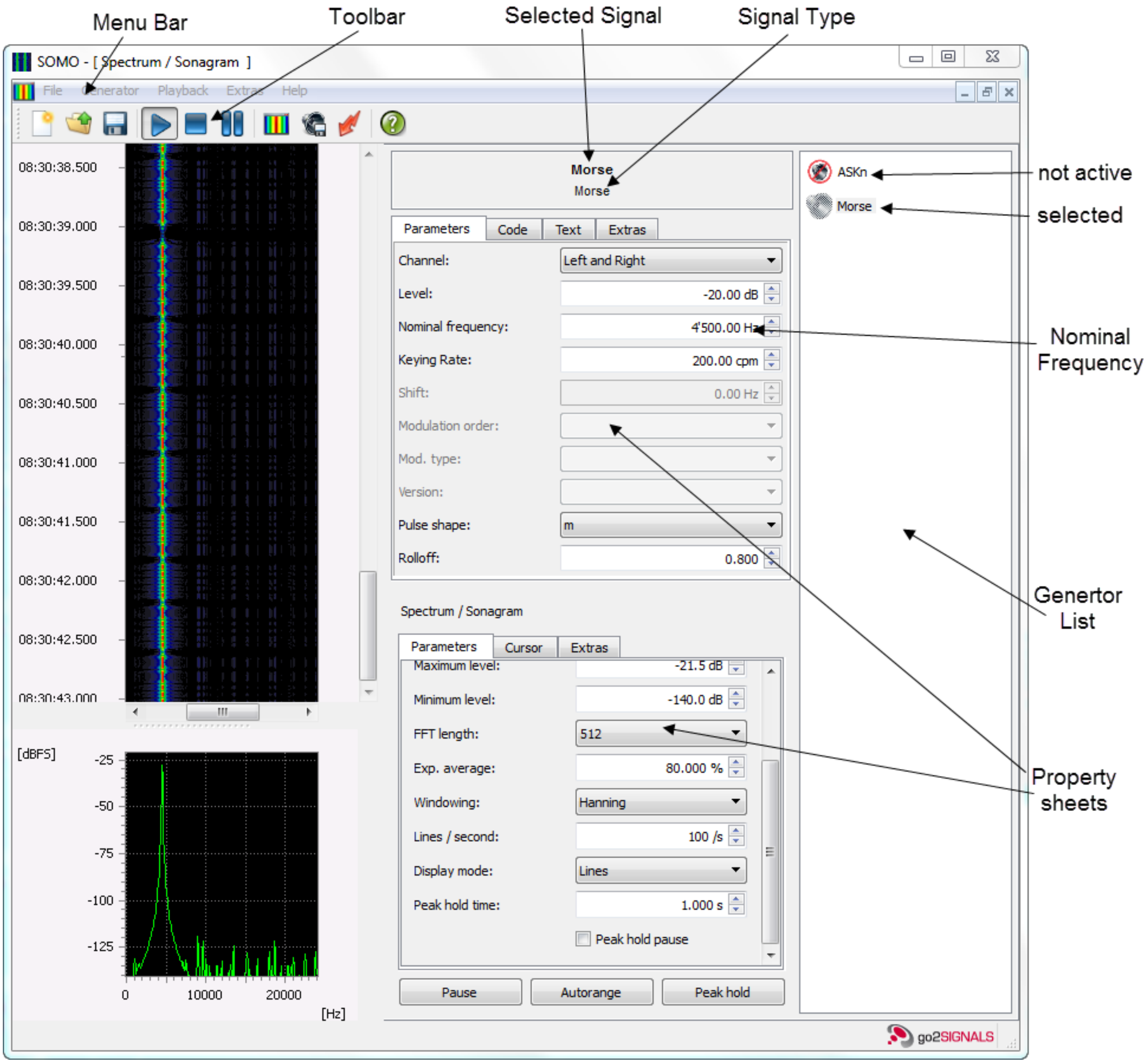


Figure 194 Signal Generation Using SOMO

Six signals are generated, two of which are inactive. The selected Morse signal has a nominal frequency of 12,500 Hz. If 12,500 Hz is entered in DANA as frequency, this Morse signal will be processed in the APC. In case another nominal frequency is entered, one of the other signals will be processed.

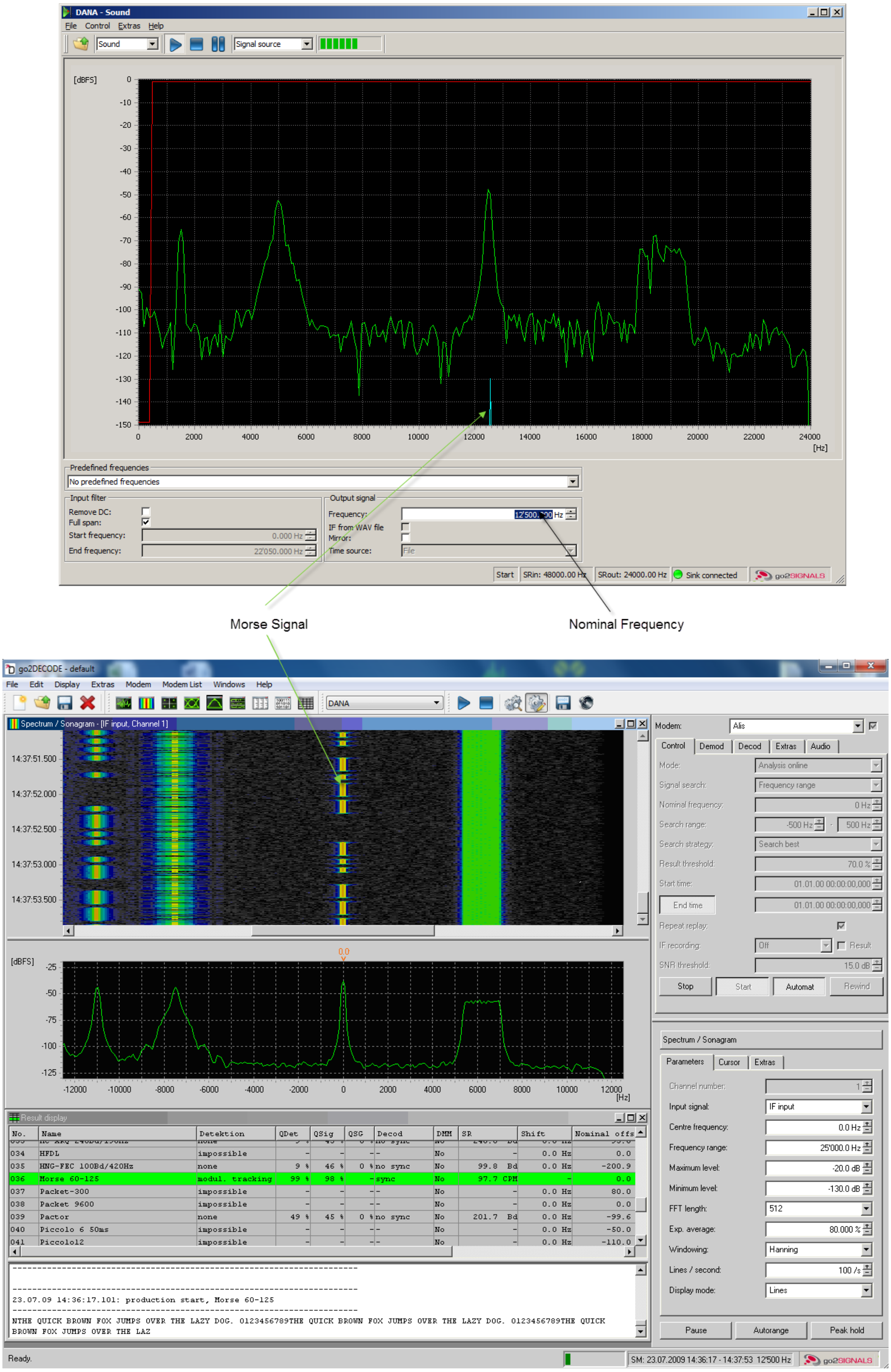


Figure 195 Morse Signal Played Back with DANA and Identified in SDA

Decoder Programming Examples

The following simple example gives an initial impression of how to use the language commands and the program structure. The intended decoding function is to identify two different start patterns in one signal and to display the resulting ASCII texts.

```
;*******************************************************************
;*                Simple Example of Decoder Programming            *
;* Following the occurrence of pattern  0011 1100 and 0011 1110    *
;* (each repeated twice) two messages of length 208 bit will be    *
;* decoded as ASCII characters                                     *
;*******************************************************************
VARDEF
; Variables and initialisations
; (Standard variable size is 32 bit)
Found
Tolerance = 0
Repeat = 2
GapLimit = 500 ;

256: Frame; Input variable of size 256 bit

ENDVARDEF
;**************************************************
START

;Main program
NewSync:

Frame = 0; Clear input text field

; Serach for the twice repeated pattern within the next 500 bit
SearchPattern(0011 1100_m, Repeat, Tolerance,, GapLimit,,Found)
;change into  0011 1110_m for second message
;        or   0011 11X0_m for both messages

If(Found)  ; If search successful
    ;Read initial pattern and message (208+16 bit) from input buffer
    GetFrame(224,Frame)
    ;Initial pattern will be shifted out (mentiont LSB-first-logic)
    Frame = Frame >> 16
    Ident(); Message "Modem detected"
    OutText(Frame,1) ;Output of ACII-Text on output channel 1
Else       ; If search failed
    Fail() ; Message "Modem not detected"
EndIf

GoTo(NewSync); Jump back to program start

END
```

Figure 196 Decoder Programming

The following files are available for this purpose in the directory:

- *Source code:* Example1e.*txt* (/examples/ddl)
- *Compiled code:* Example1e.*bin* (/examples/ddl)
- *Suitable signal:* Example1.*wav* (/examples/ddl))

To test the program, proceed as follows:

- Create a new modem list
- Create a modem (named “Test“) in this modem list using the following settings:

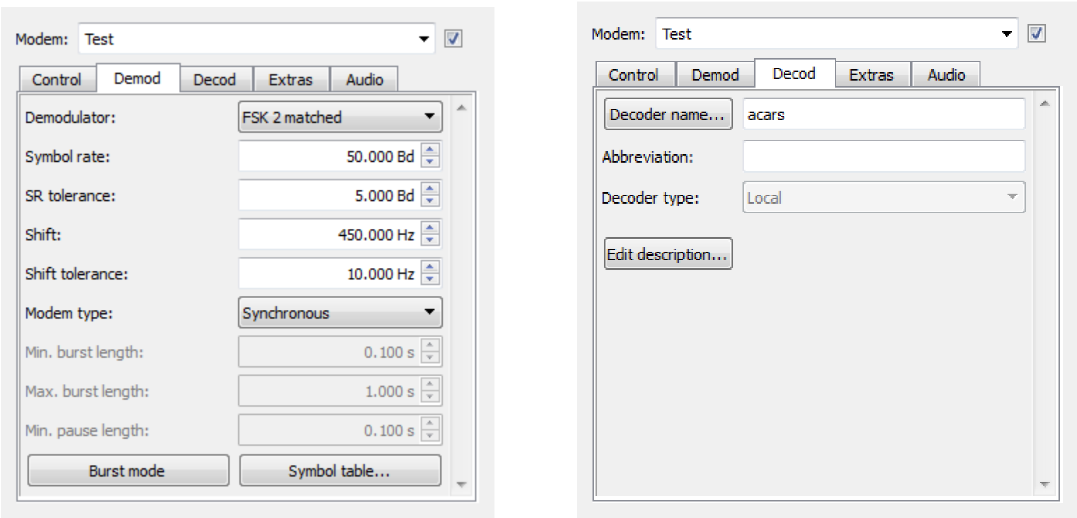


Figure 197 Demodulator/Decoder Settings

- Start DANA with a centre frequency setting of 1,800 Hz and the source *Sound*
- Start the file *Example1.wav* via a media player
- Start automatic production *(Automat)*

The result display will show a positive message of the production automat together with the decoded text:

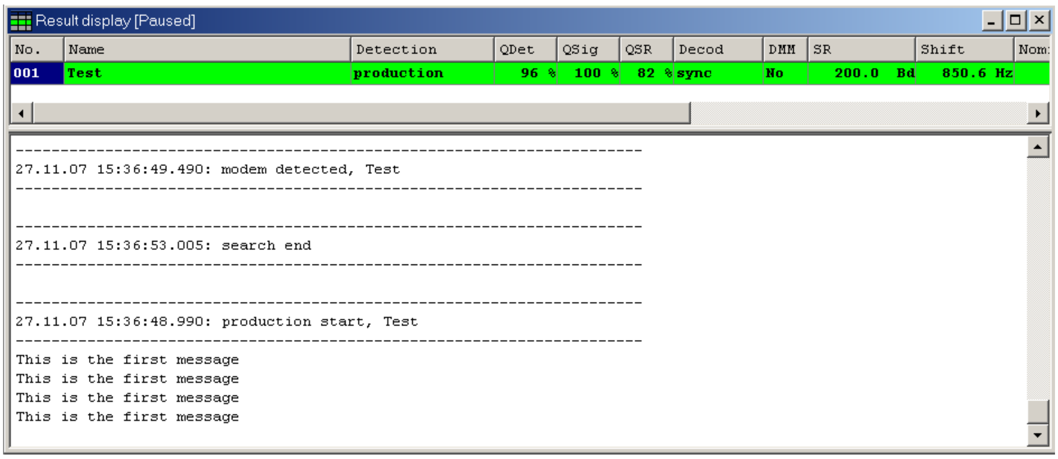


Figure 198 Result Display

- Change the search pattern as indicated in the comment lines in the section *SearchPattern*.
- Compile the source code and check for compiler error messages.
- Restart automatic production *(Automat)*. The second message is displayed:

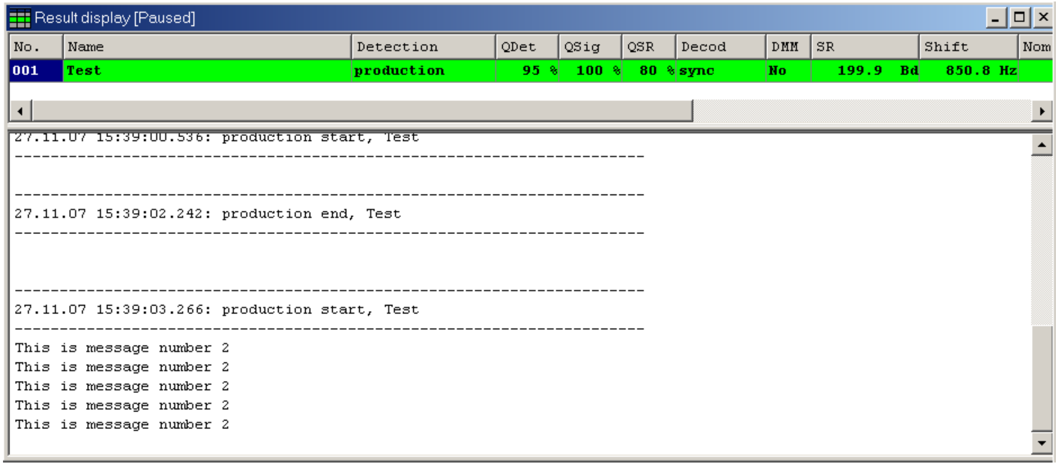


Figure 199 Result Display

As stated in the comments it is also possible to identify both patterns using X-wildcard characters and to output both messages successively.

ANNEX 6 List of Decoders

Modem	Det	Prod	Same as	Modem File
2 channel ITA-2 RTTY	X	X	F7B Morse/Baudot	
ACARS HF	X	X	HFDL	
Alcatel 801H	X	-		alcatel_801h.ver
ALIS	X	X		alis.ver
ALIS 2	X	-		alis2.ver
AMOR	X	X	CIS-14	
AMOR 96	X	X	CIS-14	
AMTOR	X	X	SITOR-A	
Annex-10	X	X	ICAO Selcal	
ARQ-1000 duplex	X	X	ARQ-E/ARQ-N	
ARQ-28	X	X	ARQ-M2 242/ARQ-M4 242	
ARQ-58	X	X	ARQ-M2 342/ARQ-M4 342	
ARQ6-90	X	X		arq_6-90.ver
ARQ6-98	X	X		arq_6-98.ver
ARQ-E Cyc4	X	X		arq_e_cyc4_85bd_170hz.ver
ARQ-E Cyc8 185Bd 370Hz	X	X		arq_e_cyc8_185bd_370hz.ver
ARQ-E Cyc8 96Bd 192Hz	X	X		arq_e_cyc8_96bd_192hz.ver
ARQ-E3 50Bd 400Hz	X	X		arq_e3_50bd_400hz.ver
ARQ-E3 100Bd 400Hz	X	X		arq_e3_100bd_400hz.ver
ARQ-M1	X	X	ARQ-E3	
ARQ-M2-242	X	X		arq_m2_242_96bd_430hz.ver
ARQ-M2-342	X	X		arq_m2_342_96bd_400hz.ver
ARQ-M2-342 200Bd 410Hz	X	X		arq_m2_342_200bd_410hz.ver
ARQ-M4-242	X	X		arq_m4_242_192bd_173hz.ver
ARQ-M4-342	X	X		arq_m4_342_192bd_400hz.ver
ARQ-N	X	X		arq_n.ver
ARQ-SWE	X	X	SWED-ARQ	
ARTRAC	X	X	DUP-ARQ	

Modem	Det	Prod	Same as	Modem File
ASCII 7Bit	X	X		ascii_7bit_100bd_173hz.ver
ASCII 8Bit	X	X		ascii_8bit_180bd_500hz.ver
AUTOSPEC	X	X		autospec.ver
Baudot sync 200Bd 850Hz	X	X		baudot_sync_200bd_850hz.ver
Baudot sync 2 stopbit 50Bd 450Hz	X	X		baudot_2stopbit_50bd_450hz.ver
Baudot sync 2 stopbit 75Bd 500Hz	X	X		baudot_2stopbit_75bd_500hz.ver
Baudot async 1,5 Stopbit 50Bd 450Hz	X	X		baudot_async_50bd_450hz.ver
Baudot async 1,5 Stopbit 50Bd 170Hz	X	X		baudot_async_50bd_170hz.ver
Baudot F7B			F7B Morse/Baudot	
BEE	X	X	CIS-36-50	
BF6 Baudot	X	X	F7B Morse/Baudot	
BULG-ASCII	X	X		bulg-ascii_75bd_510hz.ver
CCIR 242	X	X	ARQ-M2 242/ARQ-M4 242	
CCIR 342	X	X	ARQ-M2 242	
CCIR 342-2	X	X	ARQ-M4 242	
CCIR 476 A/B	X	X	Sitor A/Sitor B	
CCIR 493-4	X	X	CODAN Selcal	
CCIR 518 Variant	X	X	SWED-ARQ/ARQ6-90/ARQ6-98/POL-ARQ	
CCIR 519 Variant	X	X	ARQ-E3	
CHU	X	X		chu_fsk.ver
CIS 10 11 11	X	X	CIS 36	
CIS-11	X	X		cis-11.ver
CIS-12 PSK2	X	X		cis-12_psk2.ver
CIS-12 PSK4	X	X		cis-12_psk4.ver
CIS-14	X	X		cis-14.ver
CIS-20	X	X	CIS-12	
CIS-36	X	X		cis-36.ver
CIS-36-50	X	X		cis-36_50_50bd_250hz.ver
CIS 405 3915	X	X		cis_405_3915.ver
CIS 81	X	X	CIS 81-81	
CIS 81-29	X	X	CIS 81-81	
CIS-81-81	X	X		cis-81-81_81bd_500hz.ver
CIS AT3104	X	X	CIS-12	
Clover II	X	X		clover_II.ver
Clover 2000	X	X		clover_2000.ver
Clover 2000 Broadcast	X	X		clover_2000broadcast.ver
Clover 2500	X	X		clover_2500.ver
Clover 2500 Broadcast	X	X		clover_2500broadcast.ver
CODAN 3012 Chirp	X	X		codanchirp.ver

Modem	Det	Prod	Same as	Modem File
CODAN Selcal	X	X		codan_selcall.ver
CODAN 3012 16 Channel PSK	X	X		
CODAN 3212 16 Channel PSK	X	X		codan3212_16channel_psk.ver
CODAN 8580	X	X	CODAN Selcal	
CODAN 9001 Chirp	X	X	CODAN 3012 Chirp	
CROWD-36	X	X	CIS-36	
Coquelet-13	X	X		coquelet-13_75ms.ver
Coquelet-8	X	X		coquelet-8.ver
Coquelet-8 FEC	X	X	Coquelet-80	
Coquelet-80	X	X		coquelet-80.ver
Coquelet-100	X	X	Alcatel 801H	
Coquelet-Mk1	X	X	Coquelet13	
CW-Morse	X	X	Morse	
DGPS	X	X		dgps_200bd_msk.ver
DSC-HF	X	X		dsc-hf.ver
DUP-ARQ	X	X		dup-arq_125bd_170hz.ver
FEC-A	X	X		fec-a_145bd_850hz.ver
FEC12	X	X	Visel	
FEC 100	X	X	FEC-A	
FIRE	X	X	CIS-12	
Frost	X	X	CIS 81-81	
FROST1	X	X	CIS 405 3915	
FSK 400/500	X	-		fsk_400_500.ver
F7B Morse/Baudot	X	X		
F7B Morse	X	X		f7b_baudot_morse.ver
Globe Wireless FSK	X	X		gw_fsk_100bd_200hz.ver
Globe Wireless PSK	X	X		gw_psk_200bd_psk4.ver
Globe Wireless Pactor	X	X	Globe Wireless FSK/PSK	
GMDSS	X	X	DSC-HF	
G-TOR	X	X		g-tor_300bd_180hz.ver
Golay			G-TOR	
GW DATAPLEX	X	X	Globe Wireless FSK/PSK	
HFDL PSK-2	X	X		hfdl_psk2.ver
HNG-FEC	X	X		hng_fec.ver
Voice J3E - ICAO Selcal	X	X		voice_j3e_selcal_icao.ver
IRA-ARQ	X	X	BULG-ASCII	
ITA-2 Twin	X	X	F7B Morse/Baudot	
MD674	X	X		md674.ver
MERLIN	X	X	ALIS	
MEROD	X	X		merod.ver
MFSK-8	X	X		mfsk-8.ver
MFSK-16	X	X		mfsk-16.ver

Modem	Det	Prod	Same as	Modem File
Morse	X	X		morse_raw.ver
MS5	X	X	CIS-12	
NUM 13	X	X	SP 14	
Olivia	X	X		olivia-1000-32.ver
Packet 300-4800	X	X		packet-300-4800.ver
PACTOR I	X	X		pactor_i.ver
PACTOR I FEC	X	X		pactor_i_fec.ver
PACTOR II	X	X		pactor_ii.ver
PACTOR II FEC	X	X		pactor_ii_fec.ver
PACTOR III	X	X		pactor_iii.ver
PACTOR I/II/III	X	X		pactor.ver
Piccolo MK6	X	X		piccolo_mk6.ver
Piccolo MK12	X	X		piccolo_mk12.ver
Piccolo 6	X	X	Piccolo MK6	
Pol-ARQ	X	X		pol-arq_100bd.ver
Piccolo 12	X	X	Piccolo MK12	
PSK10	X	X		psk10.ver
PSK-AM 10Bd	X	X		psk-am_10bd.ver
PSK31	X	X		psk31.ver
PSK-AM 31Bd	X	X		psk-am_31bd.ver
PSK31-FEC	X	X		psk31fec.ver
PSK-AM 50Bd	X	X		psk-am_50bd.ver
PSK63	X	X		psk63-psk2.ver
PSK63-FEC	X	X		psk63_fec.ver
PSK125	X	X		psk125_psk2.ver
PSK125-FEC	X	X		psk125_fec.ver
PSK250	X	X		psk250.ver
PSK220-FEC	X	X		psk220_fec.ver
QPSK31	X	X		qpsk31.ver
QPSK63	X	X		
QPSK125	X	X		
QPSK250	X	X		
RAC-ARQ	X	X	MEROD	
RACAL-ARQ	X	X	MEROD	
ROU-FEC	X	X	RUM-FEC	
RS-ARQ	X	X	ALIS	
RUM-FEC	X	X		rum-fec_165bd.ver
SI-ARQ	X	X		si-arq.ver
SI-FEC	X	X		si-fec.ver
SITOR-A	X	X		sitor-a_170hz.ver
SITOR ARQ	X	X	SITOR-A	
SITOR-B 100Bd 170Hz	X	X		sitor-b_100bd_170hz.ver
SITOR-B 100Bd 400Hz	X	X		sitor-b_100bd_400hz.ver

Modem	Det	Prod	Same as	Modem File
SITOR FEC	X	X	SITOR-B	
SP14	X	X		sp14.ver
SPREAD 11	X	X	Autospec	
SPREAD 21	X	X	Autospec	
SPREAD 51	X	X		spread51.ver
Saud-FEC	X	X	RUM-FEC	
SWED-ARQ	X	X		swed_arq.ver
T-600	X	X	CIS-36-50	
TDM 242	X	X	ARQ-M2 242/ARQ-M4 242	
TDM 342	X	X	ARQ-M2 342/ARQ-M4 342	
TDM 342 1 Channel	X	X	ARQ-E3	
TOR dirty	X	X	Sitor B	
TORG 10/11	X	X	CIS-11	
Twinplex	X	X		twinplex.ver
Visel	X	X		visel.ver
Voice A3E	X	X		voice_a3e.ver
Voice A3E/J3E	X	X		voice_a3e_j3e.ver
YUG-MIL	X	X	Visel	

Table 88: HF Standard Decoders

Modem	Det	Prod	Same as	Modem File
AIS	X	X		ais.ver
ACARS VHF	X	X		acars_vhf.ver
CCITT	X	X		ccitt.ver
CCIR-1	X	X		ccir.ver
CCIR-2	X	X		ccir-2.ver
CityRuf	X	X	POCSAG	
CTCSS	X	X		ctcss.ver
DSC-VHF	X	X		dsc-vhf.ver
DMR	X	X		dmr.ver
dPMR	X	X		dpmr.ver
DZVEI	X	X		
EEA	X	X		eea.ver
EIA	X	X		eia.ver
EURO	X	X		euro.ver
EURO5	X	X	EURO	
Flex 1600Bd FSK2	X	X		flex_1600bd_fsk2.ver
Flex 1600Bd PSK2A	X	X		flex_1600bd_psk2a.ver
FMS-BOS	X	X		fms_bos.ver
GMDSS-VHF	X	X	DSC-VHF	
Golay Pager	X	X		golay_pager.ver
MPT1316	X	X	EEA	

Modem	Det	Prod	Same as	Modem File
MPT1327	X	X		mpt1327_1200bd_msk.ver
MODAT	X	X		modat.ver
NATEL	X	X		natel.ver
NMT450	X	X		nmt450.ver
Packet 1200	X	X	Packet 300	
Packet 9600	X	X		packet9600.ver
PCCIR	X	X	CCIR-1	
PDZVEI	X	X	included in ZVEI	
POCSAG	X	X		pocsag_1200bd.ver
PZVEI	X	x	included in ZVEI	
Tetra	X	X		tetra.ver
Tetrapol	X	-		tetrapol.ver
VDEW	X	X		vdew.ver
VDL 2	X	X		vdl2.ver
VDL 3	X	X		vdl3.ver
ZVEI	X	X		zvei.ver
ZVEI-1	X	X	included in ZVEI	
ZVEI-2	X	X	included in ZVEI	
ZVEI-3	X	X	included in ZVEI	
ZVEI FM Primary	X	X		zvei_fm.ver

Table 89: VUHF Standard Decoders

Modem	Det	Prod	Same as	Modem File
ALE 2G	X	X		ale.ver
CHN 4+4	X	-		chn4plus4.ver
Haegelin-Cryptos	X	X	HC-ARQ	
HC-ARQ	X	X		hc-arq.ver
LINK-11 CLEW	X	X		link-11_clew.ver
LINK-11 SLEW	X	X	STANAG 5511 SLEW	link-11_slew.ver
MD 522	X	X	MIL-M-55529A	
MIL-188-110A ser.	X	X	partly included in STANAG 4539/4415	
MIL-188-110A App. C	X	X	STANAG 4539	
MIL-188-110B ser.	X	X	partly included in STANAG 4539/4415	
MIL-188-110B App.C	X	X	partly included in STANAG 4539 HDR	
MIL-188-110 16 Tone	X	X		mil188-110_16tone.ver
MIL-188-110 39 Tone	X	X		mil188-110_39tone.ver
MIL-188-141A	X	X	ALE(2G)	
MIL-188-141B	X	X	ALE(2G)	
MIL-M-55529A	X	X		mil-m-55529a.ver
STANAG 4197	X	X		stanag4197.ver
STANAG 4285	X	X		stanag4285.ver

Modem	Det	Prod	Same as	Modem File
STANAG 4415	X	X		stanag4415.ver
STANAG 4481 (FSK)	X	X		stanag4481_fsk.ver
STANAG 4481 (PSK)	X	X		stanag4481_psk.ver
STANAG 4529	X	X		stanag4529.ver
STANAG 4539	X	X		stanag4539.ver
STANAG 4539 HDR	X	X		stanag4539-hdr.ver
STANAG 5065	X	X		stanag_5065_fsk.ver
STANAG 5066	X	X	included in STANAG 4285	
STANAG 5511	X	X	LINK11 CLEW	
STANAG 5511 SLEW	X	X	LINK11 SLEW	
TADIL A	X	X	LINK11 CLEW	
TADIL B	X	X	LINK11 CLEW	

Table 90: Premium Decoders

Note :
For Premium decoders the source-code is not available.

Standard Decoders HF

Version History

Release	Date	Editor	History
1.0	2013-07-05	MBu	Start

Available Decoders

Alcatel 801H

General Information

Alcatel-801H is an 8 tone MFSK ARQ teleprinter system.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Tone length (ms)	10
Tone spacing (Hz)	100

Table 91: Alcatel 801H Characteristics

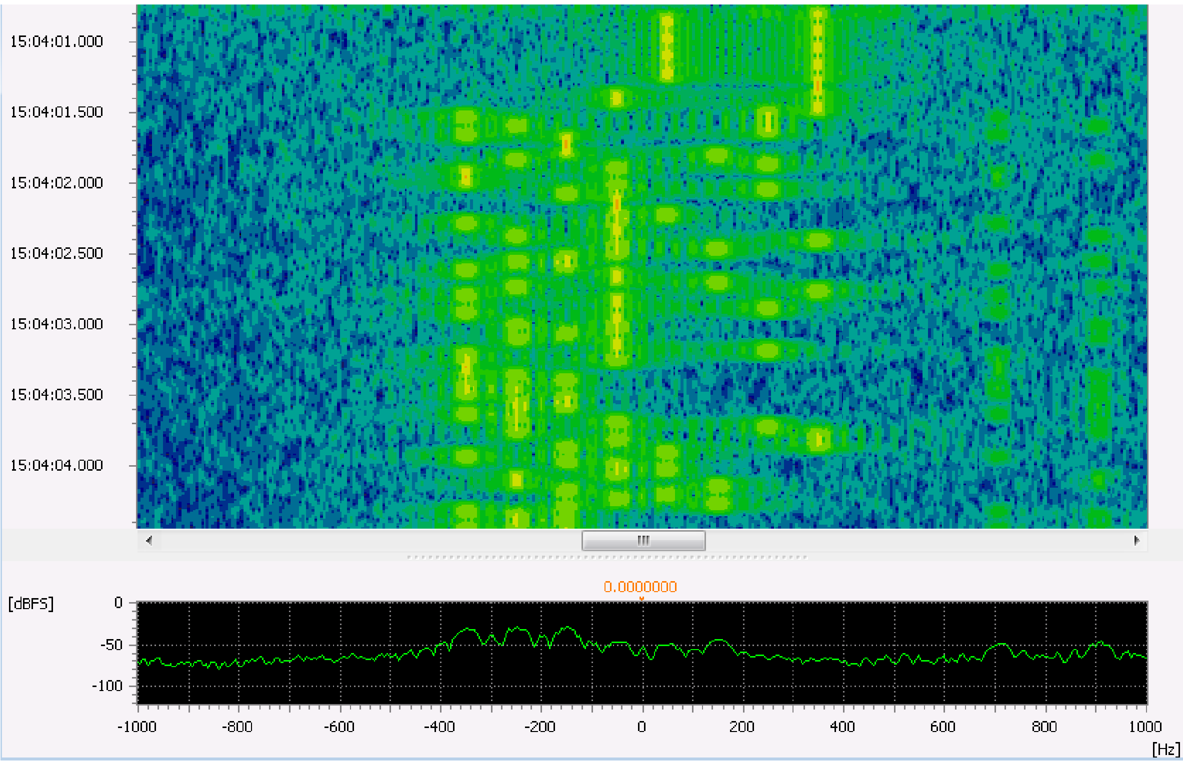


Figure 200: Alcatel 801H Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Coquelet
Tone duration (ms)	10
TD tolerance (ms)	0
No. of tones	8
Tone distance (Hz)	100
VER file name	*alcatel_801h.ver*

Table 92: Alcatel 801H Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 93: Alcatel 801H Features

ALIS

General Information

ALIS is a simplex ARQ teleprinter system developed by Rhode & Schwarz.

Usage:

- Transfer of textual information over HF with automatic Link setup.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Symbol rate (Bd)	228.7
Error correction	CRC-16
Alphabet	ITA-2

Table 94: ALIS Characteristics

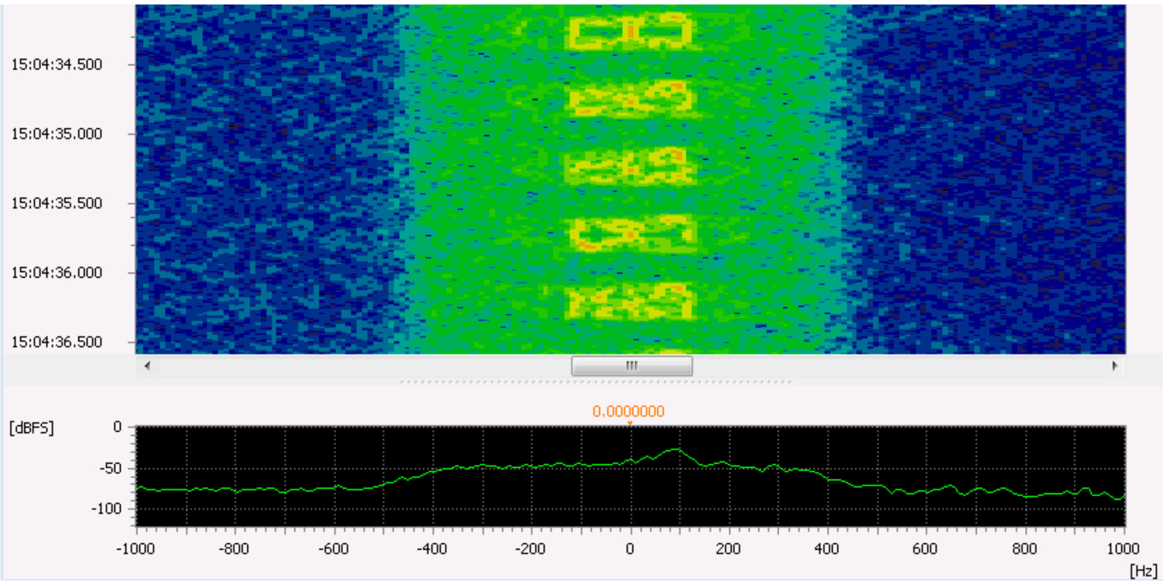


Figure 201: ALIS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	228.67
SR tolerance (Bd)	1.000
Modulation order	2
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.210
Max. burst length (s)	0.260

Parameter	Default
Min. pause length (s)	0.010
VER file name	*alis.ver*

Table 95: ALIS Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 96: ALIS Features

ALIS-2

General Information

ALIS-2 is simplex ARQ teleprinter system developed by Rhode & Schwarz.
ALIS-2 is a further development of ALIS.

Usage:

- Transfer of textual information and binary data over HF with automatic Link setup.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Tone spacing (Hz)	240
Symbol rate (Bd)	240.82
Error correction	CRC-16
Alphabet	ITA-5

Table 97: ALIS-2 Characteristics

![go2DECODE logo]

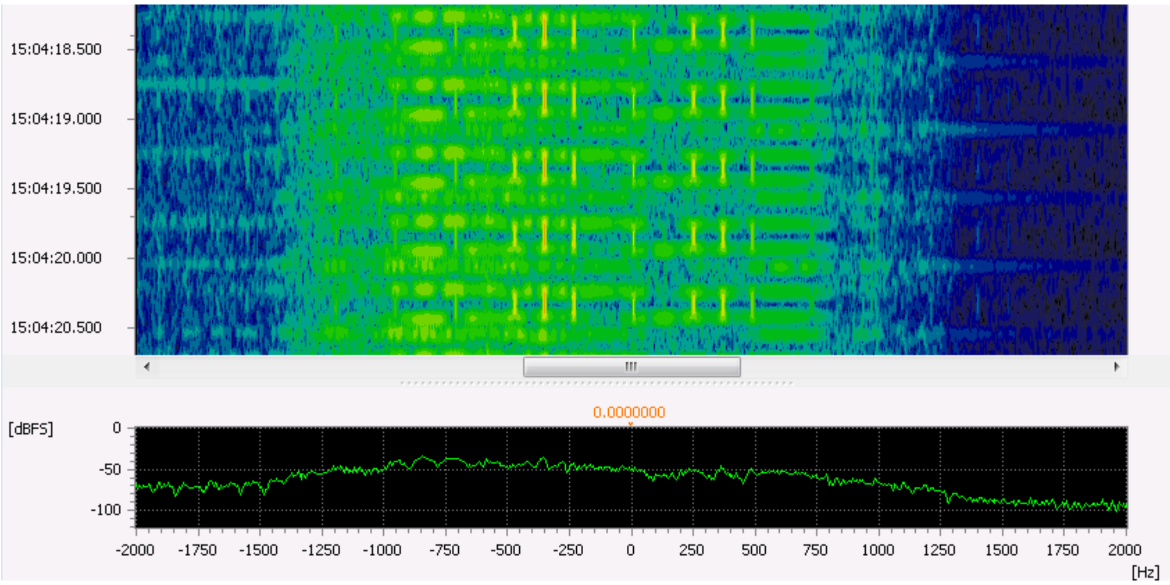


Figure 202: ALIS-2 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (FSKn)
Tone duration (ms)	4.153
TD tolerance (ms)	0.100
No. of tones	8
Tone position type	Equidistant frequencies
Tone distance (Hz)	240.816
Min. burst length (s)	0.040
Max. burst length (s)	0.350
Min. pause length (s)	0.070
VER file name	*alis2.ver*

Table 98: ALIS-2 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 99: ALIS-2 Features

ARQ-6-90

General Information

ARQ-6-90 is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	600
Symbol rate (Bd)	200
Error correction	ARQ
Alphabet	CCIR-476

Table 100: ARQ-6-90 Characteristics

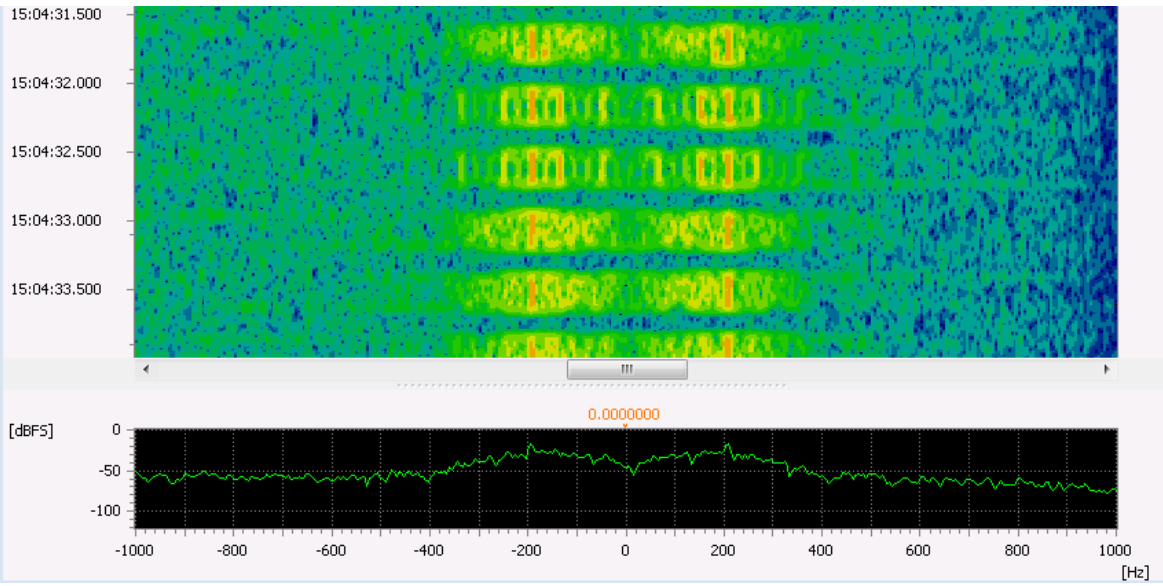


Figure 203: ARQ-6-90 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.065

Parameter	Default
Max. burst length (s)	0.260
Min. pause length (s)	0.200
VER file name	*arq_6-90.ver*

Table 101: ARQ-6-90 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 102: ARQ-6-90 Features

ARQ-6-98

General Information

ARQ-6-98 is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	400
Symbol rate (Bd)	200
Error correction	ARQ
Alphabet	CCIR-476

Table 103: ARQ-6-98 Characteristics

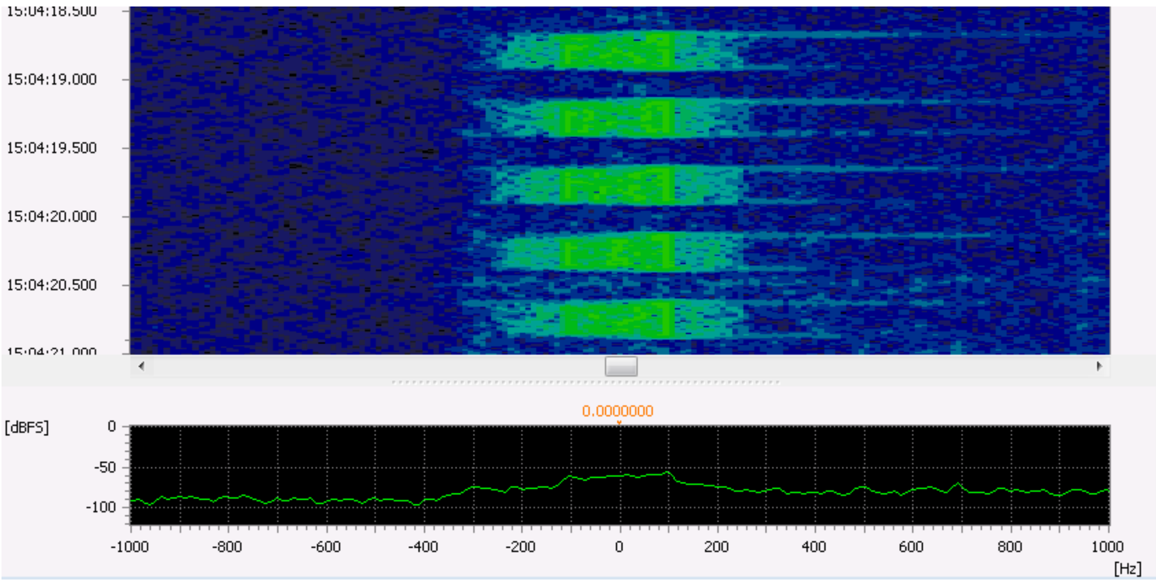


Figure 204: ARQ-6-98 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	170
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.065
Max. burst length (s)	0.260
Min. pause length (s)	0.150
VER file name	*arq_6-98.ver*

Table 104: ARQ-6-98 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 105: ARQ-6-98 Features

ARQ-E

General Information

ARQ-E is a synchronous dual channel ARQ mode for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Military or diplomatic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170 / 370
Bandwidth (Hz)	300 / 600
Symbol rate (Bd)	30 … 650
Error correction	ARQ
Alphabet	ITA-2 extended

Table 106: ARQ-E Characteristics

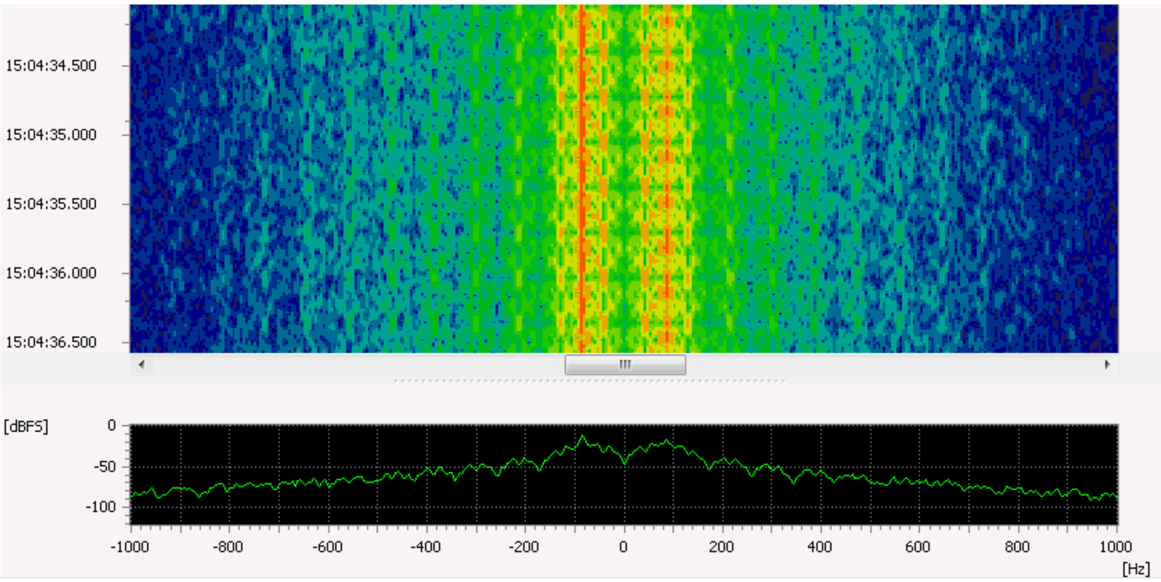


Figure 205: ARQ-E cyc4 Spectrogram

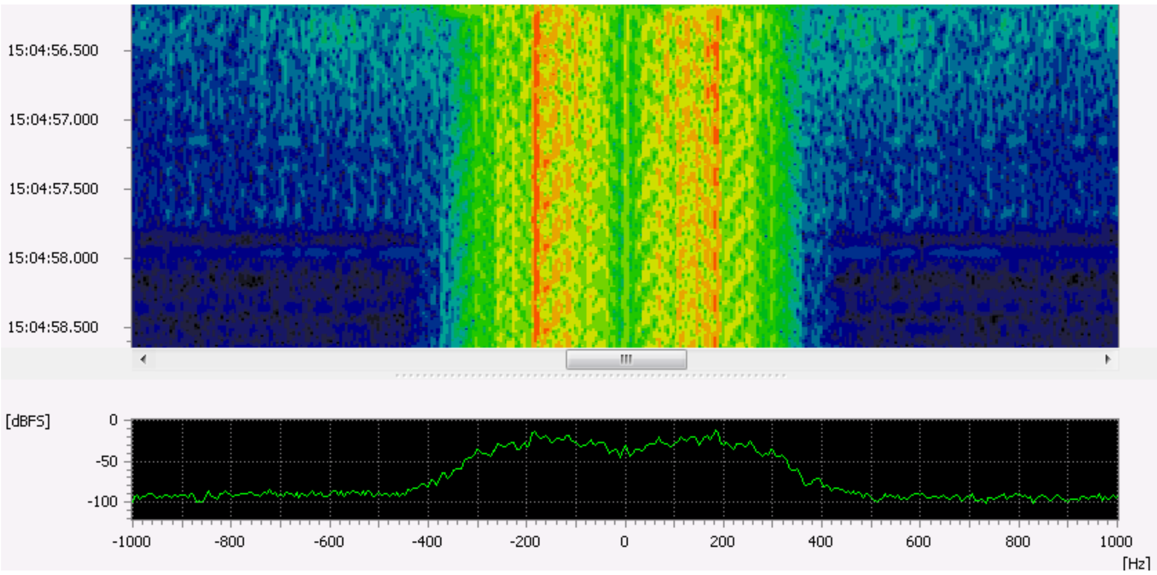


Figure 206: ARQ-E cyc8 Spectrogram

Demodulator Settings

Parameter	Default	
Demodulator	FSK 2 matched	
Symbol rate (Bd)	85.7	185
SR tolerance (Bd)	4	5
Shift (Hz)	170	370
Shift tolerance (Hz)	20	
Modem type	Synchronous	
VER file name	arq_e_cyc4_85bd_170hz.ver	arq_e_cyc8_185bd_370hz.ver

Table 107: ARQ-E Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 108: ARQ-E Features

ARQ-E3

General Information

ARQ-E3 is a synchronous dual channel ARQ mode for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Military or diplomatic data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	600
Symbol rate (Bd)	30 … 650
Error correction	ARQ
Alphabet	ITA-3

Table 109: ARQ-E3 Characteristics

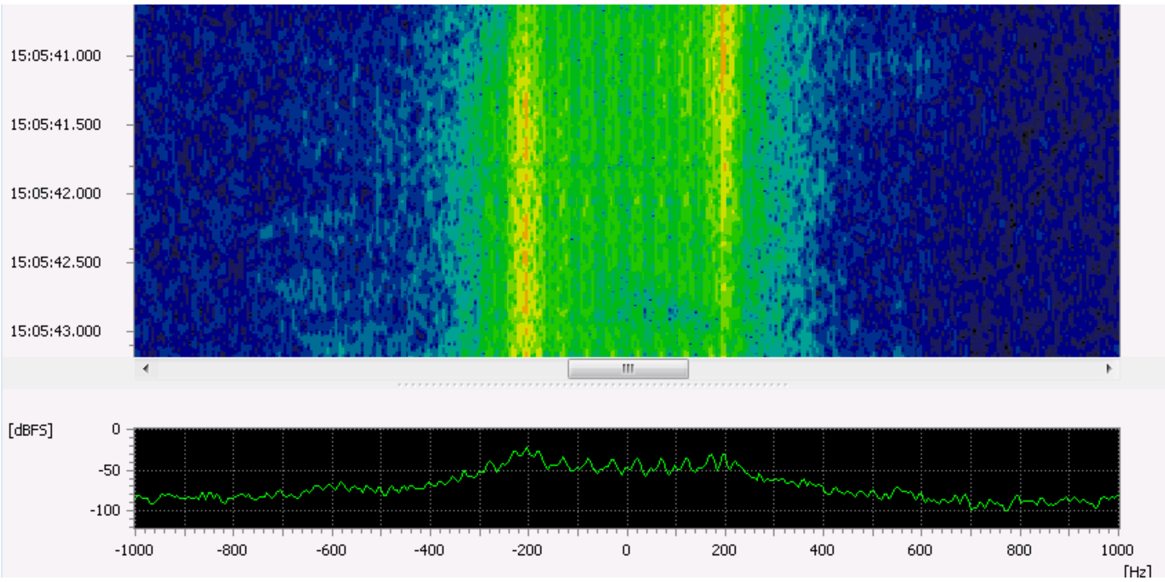


Figure 207: ARQ-E3 cyc8 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	500
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*arq_e3_50bd_400hz.ver*

Table 110: ARQ-E3 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 111: ARQ-E3 Features

ARQ-M2-242

General Information

ARQ-M2-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	430
Bandwidth (Hz)	600 / 800
Symbol rate (Bd)	96 / 200
Alphabet	ITA-3

Table 112: ARQ-M2-242 Characteristics

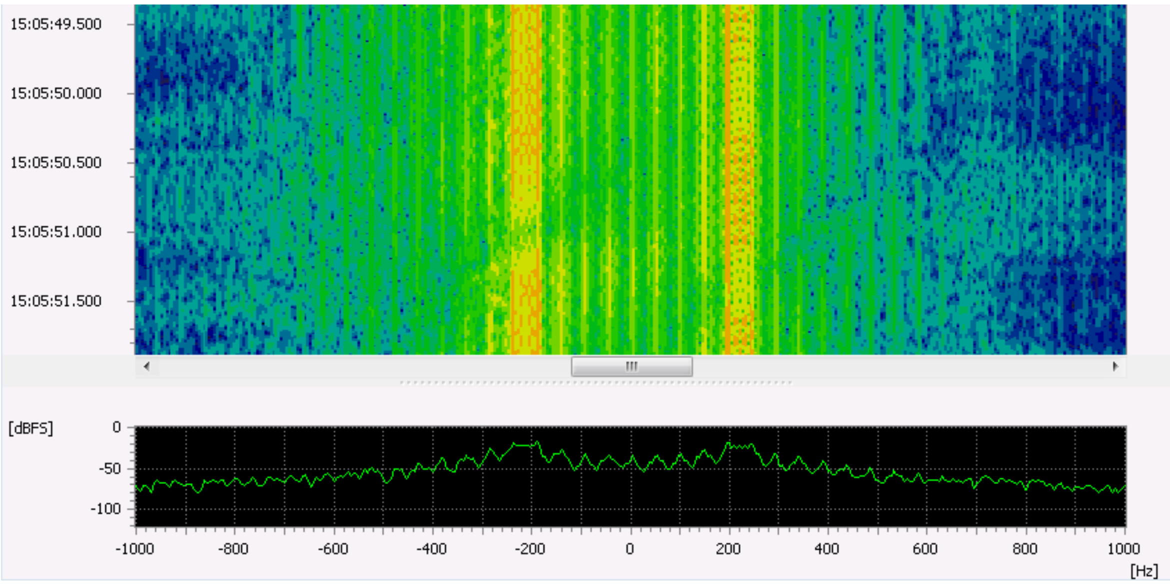


Figure 208: ARQ-M2-242 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	430
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*arq_m2_242_96bd_430hz.ver*

Table 113: ARQ-M2-242 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 114: ARQ-M2-242 Features

ARQ-M2-342

General Information

ARQ-M2-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	600 / 800
Symbol rate (Bd)	96 / 200
Alphabet	ITA-3

Table 115: ARQ-M2-342 Characteristics

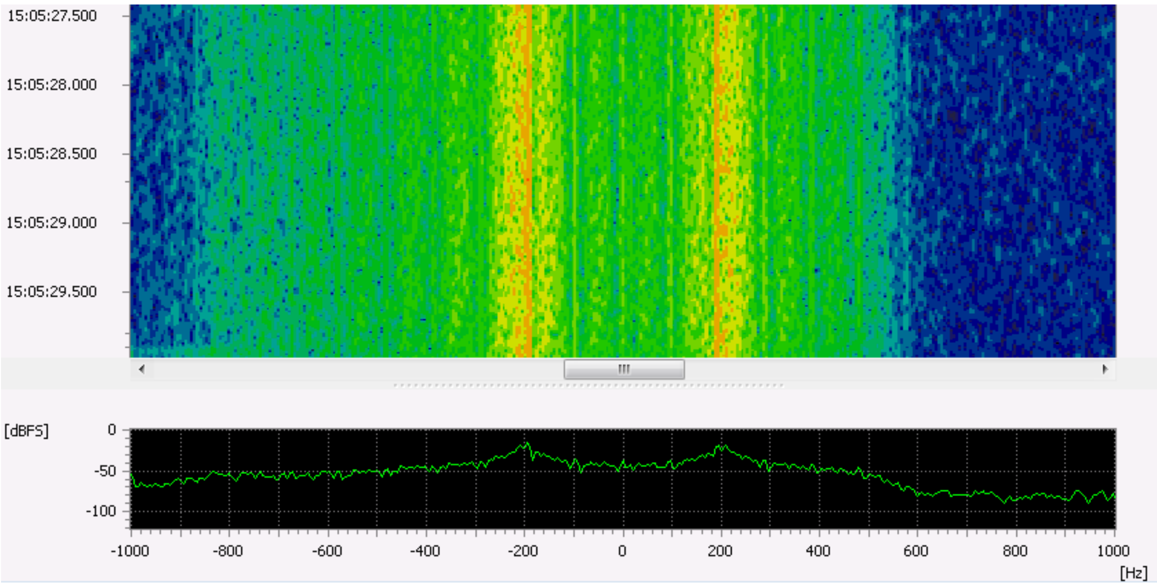


Figure 209: ARQ-M2-342 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*arq_m2_342_96bd_400hz.ver*

Table 116: ARQ-M2-342 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 117: ARQ-M2-342 Features

ARQ-M4-242

General Information

ARQ-M4-242 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	400
Symbol rate (Bd)	172 / 192
Alphabet	ITA-3

Table 118: ARQ-M4-242 Characteristics

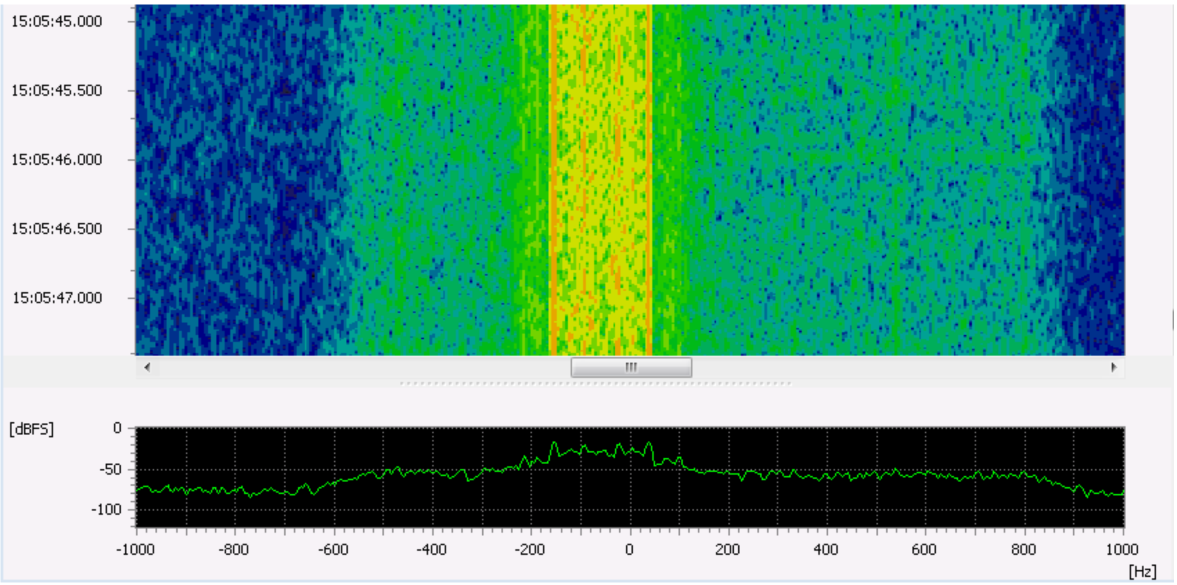


Figure 210: ARQ-M4-242 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	192
SR tolerance (Bd)	2
Modulation order	2
Shift (Hz)	173
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*arq_m4_242_192bd_173hz.ver*

Table 119: ARQ-M4-242 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 120: ARQ-M4-242 Features

ARQ-M4-342

General Information

ARQ-M4-342 is a synchronous full duplex time-division multiplex system designed for low error-rate exchange of textual data between two stations of governmental authorities.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Bandwidth (Hz)	800
Symbol rate (Bd)	172 / 192
Alphabet	ITA-3

Table 121: ARQ-M4-342 Characteristics

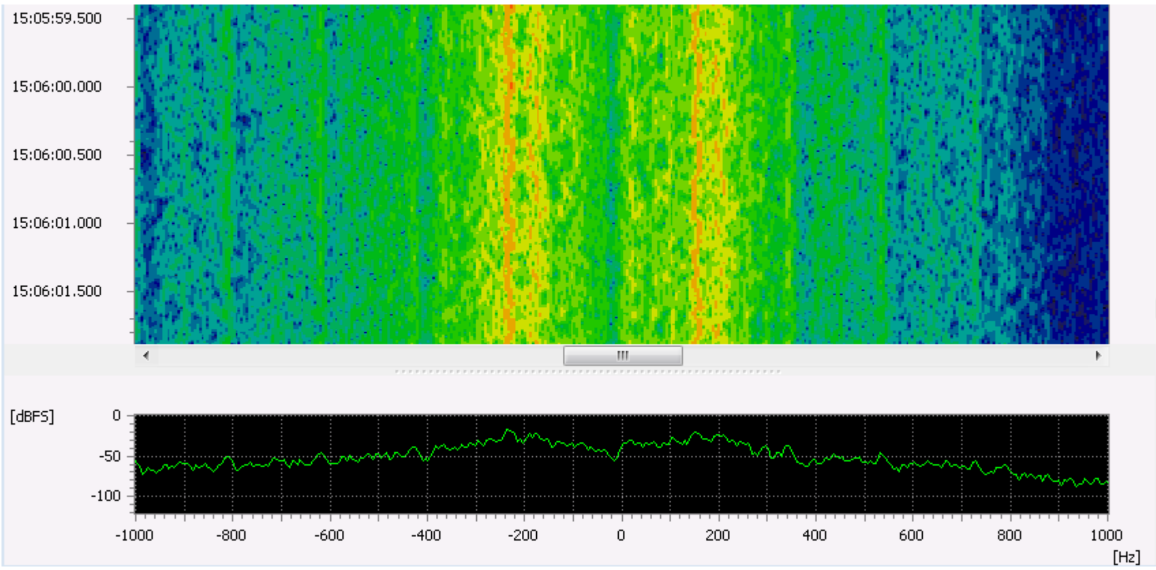


Figure 211: ARQ-M4-342 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	192
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*arq_m4_342_192bd_400hz.ver*

Table 122: ARQ-M4-342 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 123: ARQ-M4-342 Features

ARQ-N

General Information

ARQ-E is a synchronous dual channel ARQ mode. This system was used by Italian diplomatic services.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	850
Symbol rate (Bd)	96
Error correction	ARQ
Repetition cycles (char)	4,5,8
Alphabet	ITA-2P

Table 124: ARQ-N Characteristics

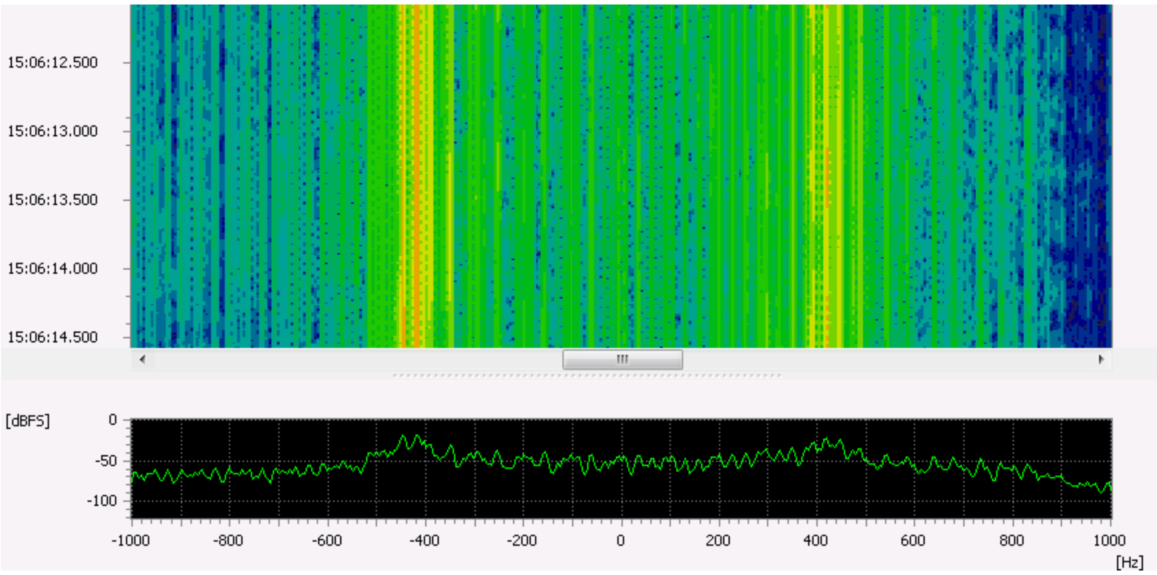


Figure 212: ARQ-N Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	850
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*arq_n.ver*

Table 125: ARQ-N Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 126: ARQ-N Features

ASCII 7 Bit

General Information

The American Standard Code for Information Interchange (ASCII) is a set of binary values to represent printable characters in electronic communication.

In the first version of the standard the character-length was 7 bit.

Usage:

- Transfer of textual information over HF.
- Processing, transfer and storage of textual information.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	173
Bandwidth (Hz)	300
Symbol rate (Bd)	100
Character	1 Start-, 7 Data-, 1 Stop-Bit

Table 127: ASCII 7 Bit Characteristics

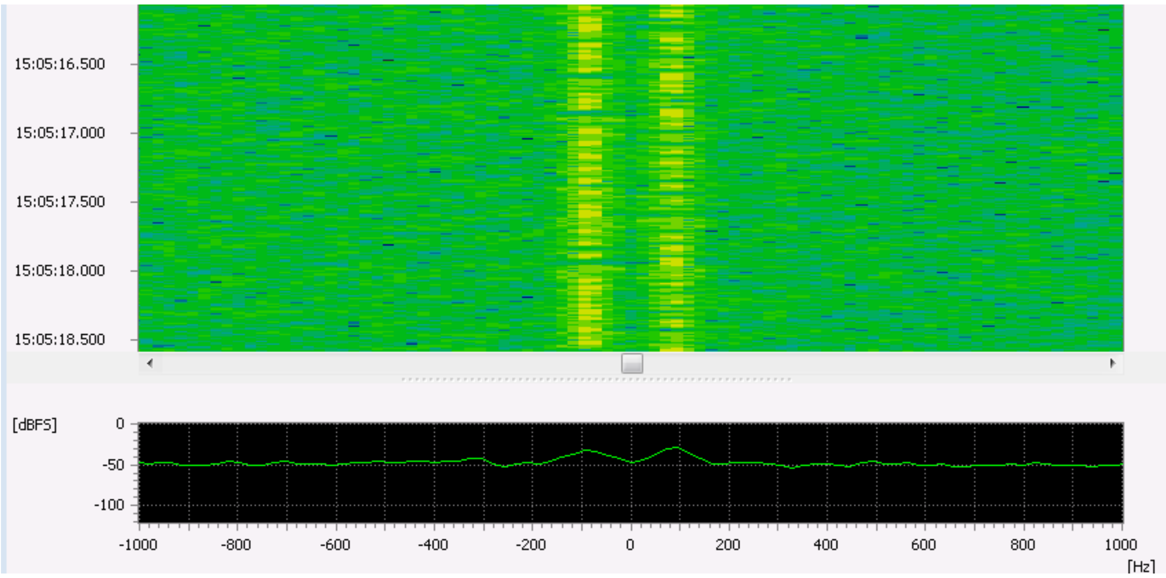


Figure 213: ASCII 7 Bit Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	173
Shift tolerance (Hz)	10
Modem type	Synchronous

Parameter	Default
VER file name	*ascii_7bit_100bd_173hz.ver*

Table 128: ASCII 7 Bit Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 129: ASCII 7 Bit Features

ASCII 8 Bit

General Information

The American Standard Code for Information Interchange (ASCII) is a set of binary values to represent printable characters in electronic communication.
In a later version of the standard the character-length was extended to 8 bit.

Usage:

- Processing, transfer and storage of textual information.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	492
Bandwidth (Hz)	700
Symbol rate (Bd)	150
Character	1 Start-, 8 Data-, 2 Stop-Bit

Table 130: ASCII 8 Bit Characteristics

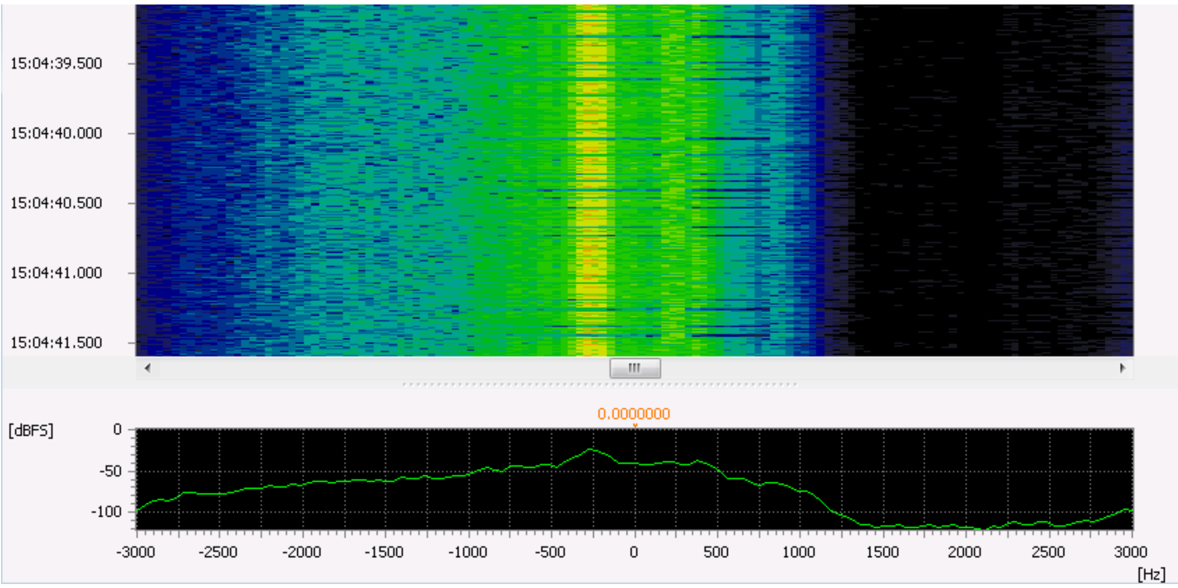


Figure 214: ASCII 8 Bit Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	180
SR tolerance (Bd)	90
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*ascii_8bit_180bd_500hz.ver*

Table 131: ASCII 8 Bit Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 132: ASCII 8 Bit Features

AUTOSPEC

General Information

Autospec is a synchronous FEC system. This system was used by British coastal station for communication to oil rigs.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	270
Symbol rate (Bd)	68.5
Alphabet	ITA-2

Table 133: AUTOSPEC Characteristics

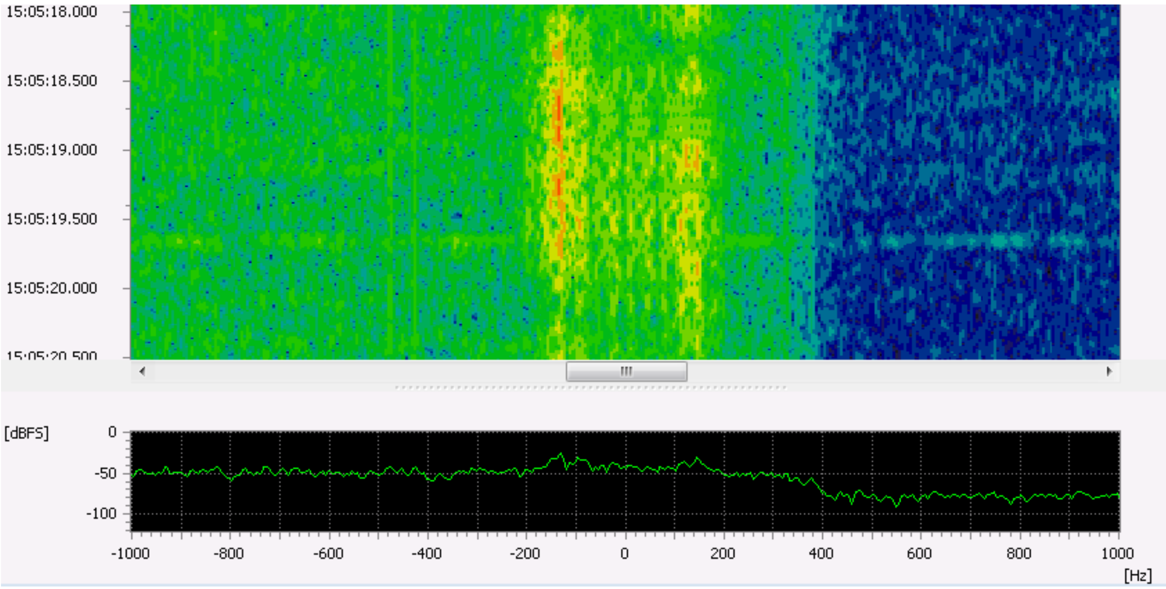


Figure 215: AUTOSPEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	68.5
SR tolerance (Bd)	1
Shift (Hz)	270
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*autospec.ver*

Table 134: AUTOSPEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 135: AUTOSPEC Features

Baudot async

General Information

The asynchronous Baudot mode is a means to transfer printable characters over a communication channel. Synchronisation in this case is achieved by the use of a Start-Bit, which has the polarity reverse to the Stop-Bit and the Idle-State.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	450 / 850
Bandwidth (Hz)	800 / 1500
Symbol rate (Bd)	50 / 75 / 100
Character	1 Start-, 5 Data-, 1/1.5/2 Stop-Bit

Table 136: Baudot async Characteristics

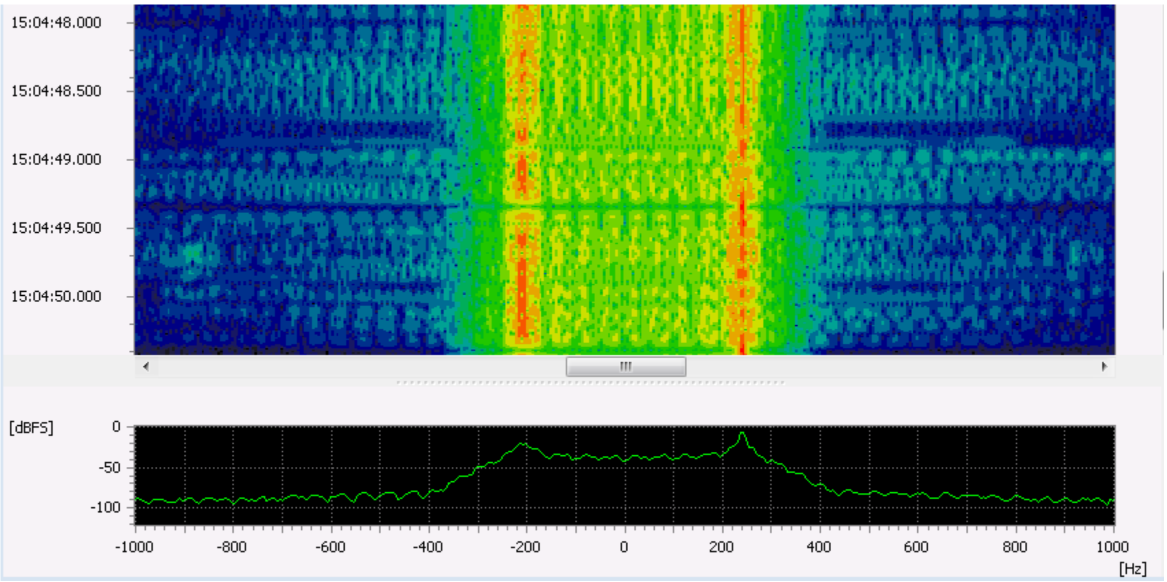


Figure 216: Baudot async Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	50
SR tolerance (Bd)	5
Shift (Hz)	450
Shift tolerance (Hz)	10
Modem type	Asynchronous
VER file name	*baudot_async_50bd_450hz.ver*

Table 137: Baudot async Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 138: Baudot async Features

Baudot sync

General Information

The synchronous Baudot mode is a means to transfer printable characters over a communication channel. Synchronisation in this case is achieved by using a fixed character-length and a combination of Start- and Stop-Bit of reverse polarity.

Usage:

- Transfer of textual information.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	450 / 850
Bandwidth (Hz)	800 / 1500
Symbol rate (Bd)	200
Character	1 Start-, 5 Data-, 1 Stop-Bit

Table 139: Baudot sync Characteristics

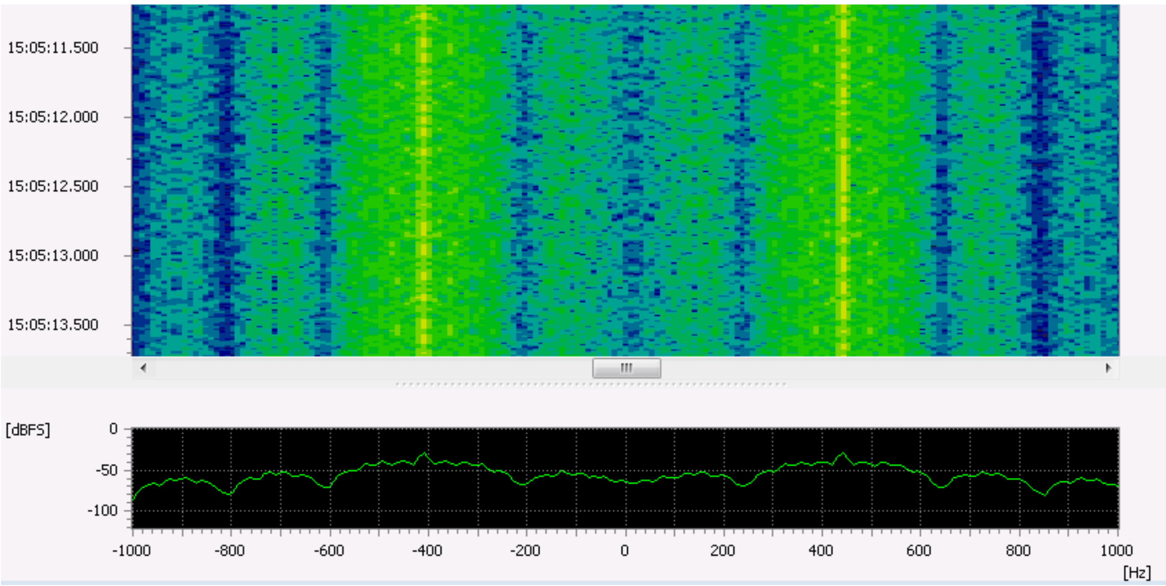


Figure 217: Baudot sync Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Shift (Hz)	850
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*baudot_sync_200bd_850hz.ver*

Table 140: Baudot sync Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 141: Baudot sync Features

BULG-ASCII

General Information

BULG-ASCII is a modem used by the Bulgarian Ministry of Foreign Affairs.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Bandwidth (Hz)	600
Symbol rate (Bd)	120

Table 142: BULG-ASCII Characteristics

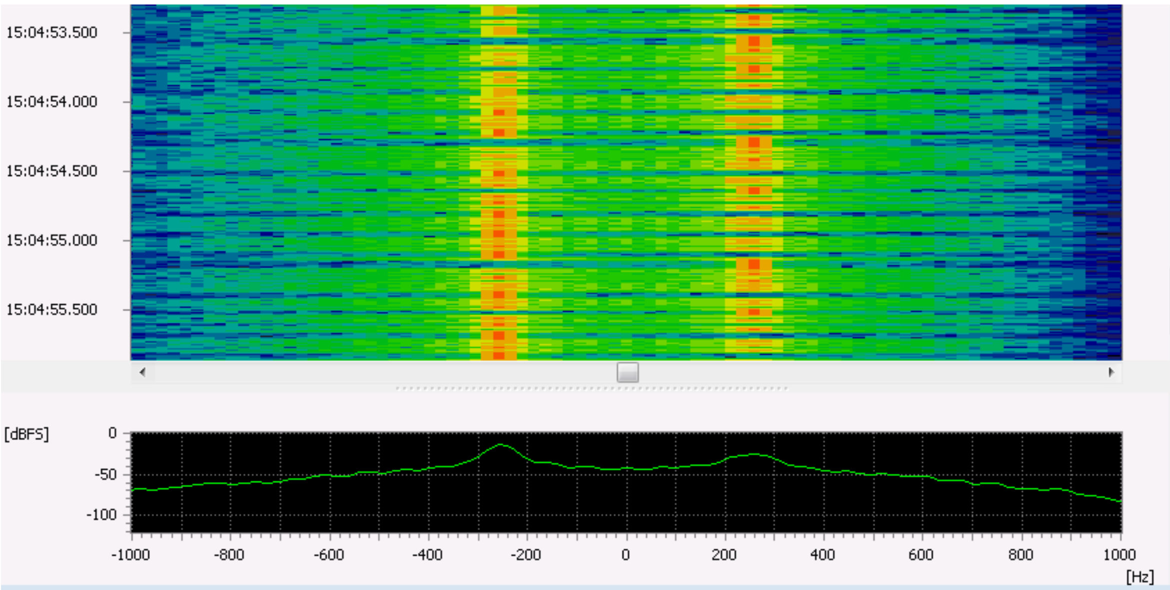


Figure 218: BULG-ASCII Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	75
SR tolerance (Bd)	10
Shift (Hz)	510
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*bulg-ascii_75bd_510hz.ver*

Table 143: BULG-ASCII Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 144: BULG-ASCII Features

CHU

General Information

CHU is a radio station in Canada that continuously broadcasts time of day information. It is operated by the National Research Council of Canada.

Usage:

- Time information broadcasts.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	500
Symbol rate (Bd)	500
Coding	BCD

Table 145: CHU Characteristics

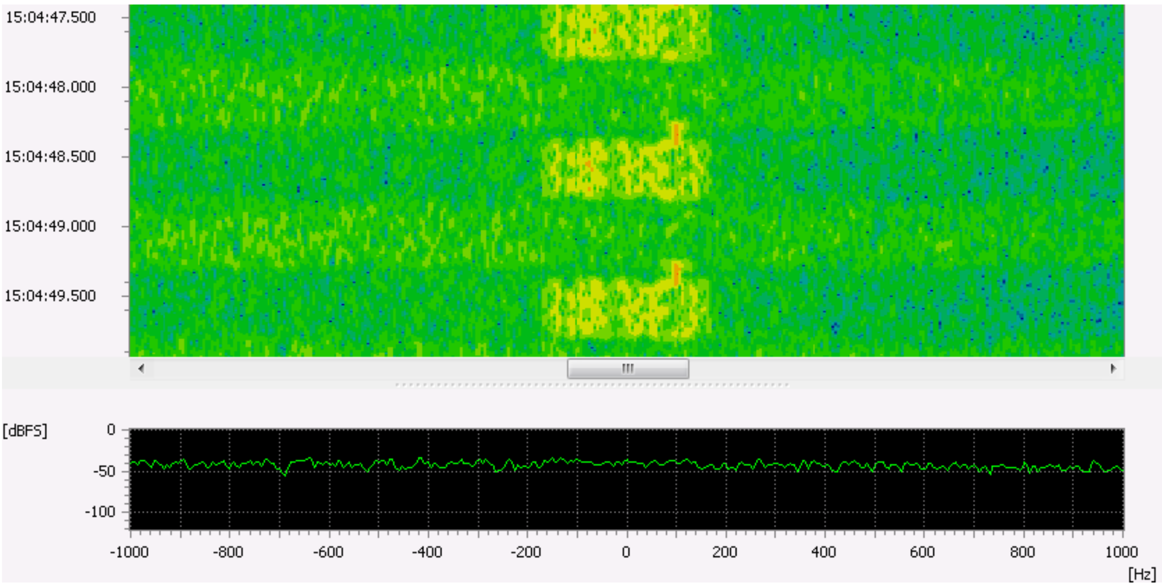


Figure 219: CHU Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	300
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	5
Modem type	Synchronous
Min. burst length (s)	0.200

Parameter	Default
Max. burst length (s)	0.700
Min. pause length (s)	0.150
VER file name	*chu_fsk.ver*

Table 146: CHU Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 147: CHU Features

CIS-11

General Information

CIS-11 is a full duplex teleprinter system used in former CIS (Commonwealth of Independent States).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Symbol rate (Bd)	100
Error correction	Parity
Alphabet	ITA-2

Table 148: CIS-11 Characteristics

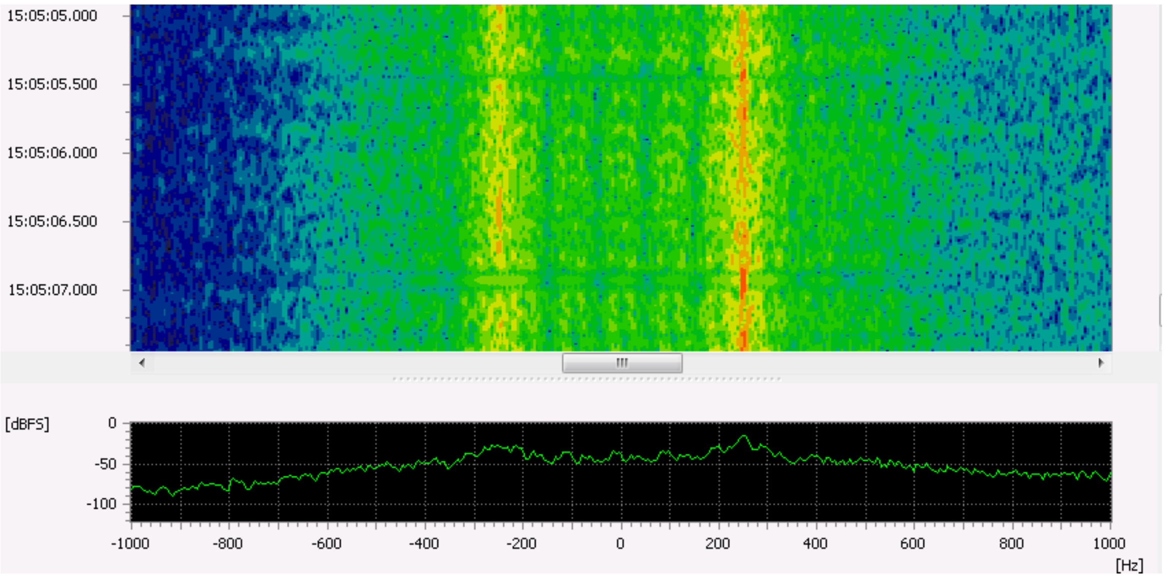


Figure 220: CIS-11 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-11.ver*

Table 149: CIS-11 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 150: CIS-11 Features

CIS-12

General Information

CIS-12 is a Soviet military multi-channel modem. It features scrambled voice- or data-communication at a maximum data rate of 4800 bits/sec.
This modem system is also known as MS5 and FIRE.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	Multi-channel PSK2 / PSK4
Number of channels	2
Channel spacing (Hz)	200
Symbol rate (Baud)	120
Coding	Vocoder
Pilot tone (Hz)	3300

Table 151: CIS-12 Characteristics

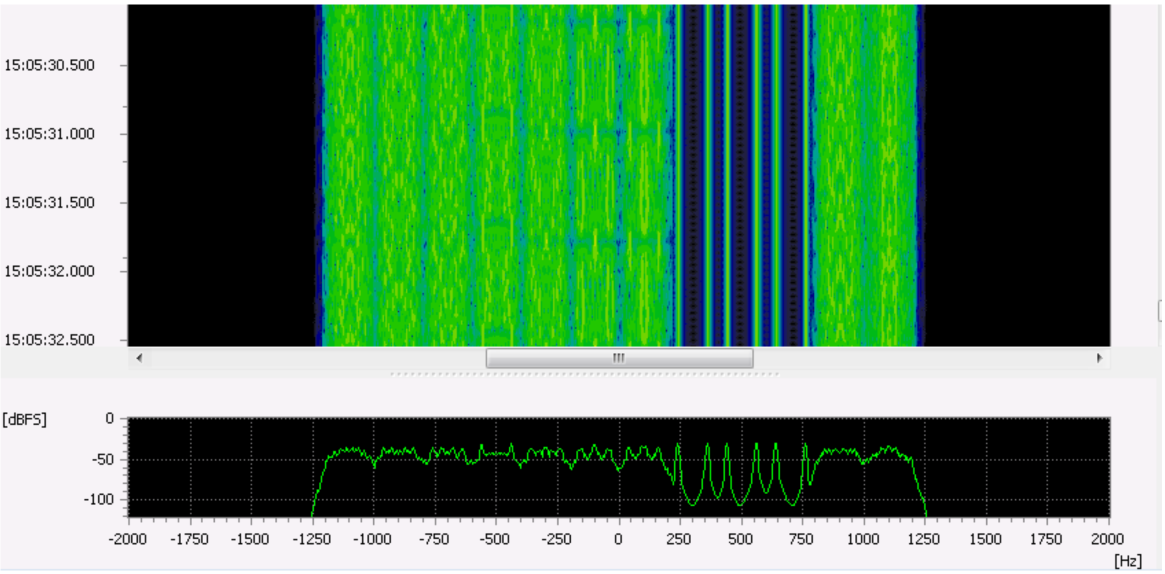


Figure 221: CIS-12 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Bd)	120
SR tolerance (Bd)	5
Modulation order	4
Version	A
No. of channels	12
Channel position type	Channel distance

Parameter	Default
Channel distance (Hz)	200
VER file name	*cis-12_psk4.ver*

Table 152: CIS-12 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 153: CIS-12 Features

CIS-14

General Information

CIS-14 is a synchronous duplex teleprinter system with ARQ.
This modem system is also known as AMOR and AMOR96.

Usage:

- Data communication over HF.
- Point-to-point communication between stations in CIS (Commonwealth of Independent States)-region.

Mode Properties

Parameter	Value
Modulation	FSK
Number of channels	2
Shift (Hz)	500
Bandwidth (Hz)	700
Symbol rate (Baud)	96
Coding	Parity check
Alphabet	M2 cyrillic

Table 154: CIS-14 Characteristics

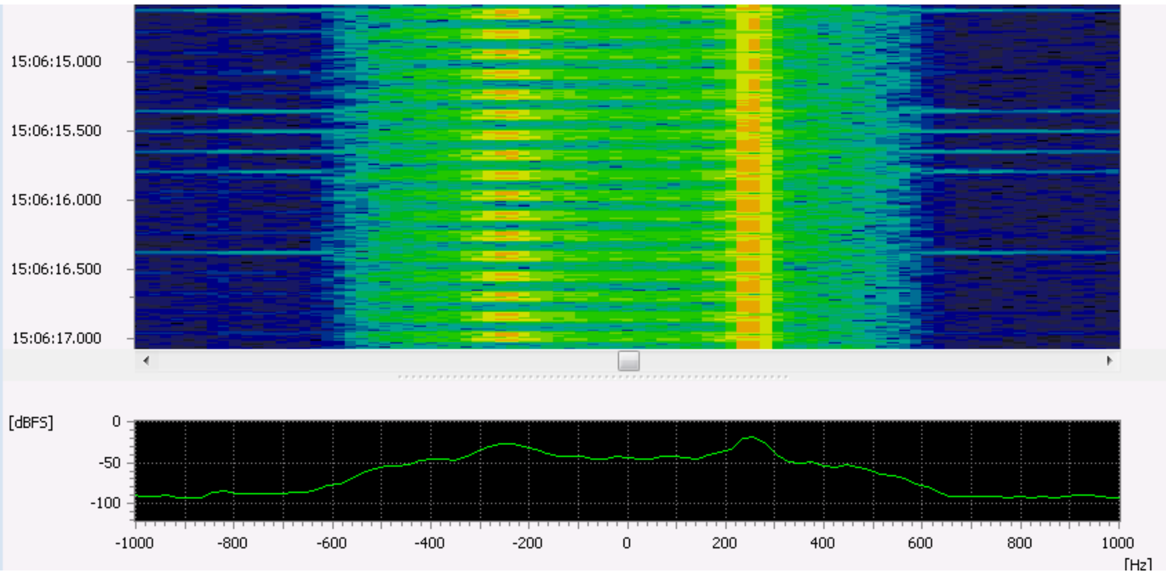


Figure 222: CIS-14 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-14.ver*

Table 155: CIS-14 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 156: CIS-14 Features

CIS-36

General Information

CIS-36 is a modem used by the Soviet military and diplomatic services.
This modem system is also known as CROWD 36.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	36
Tone spacing (Hz)	40
Bandwidth (Hz)	2000
Symbol rate (Baud)	40
Encryption	

Table 157: CIS-36 Characteristics

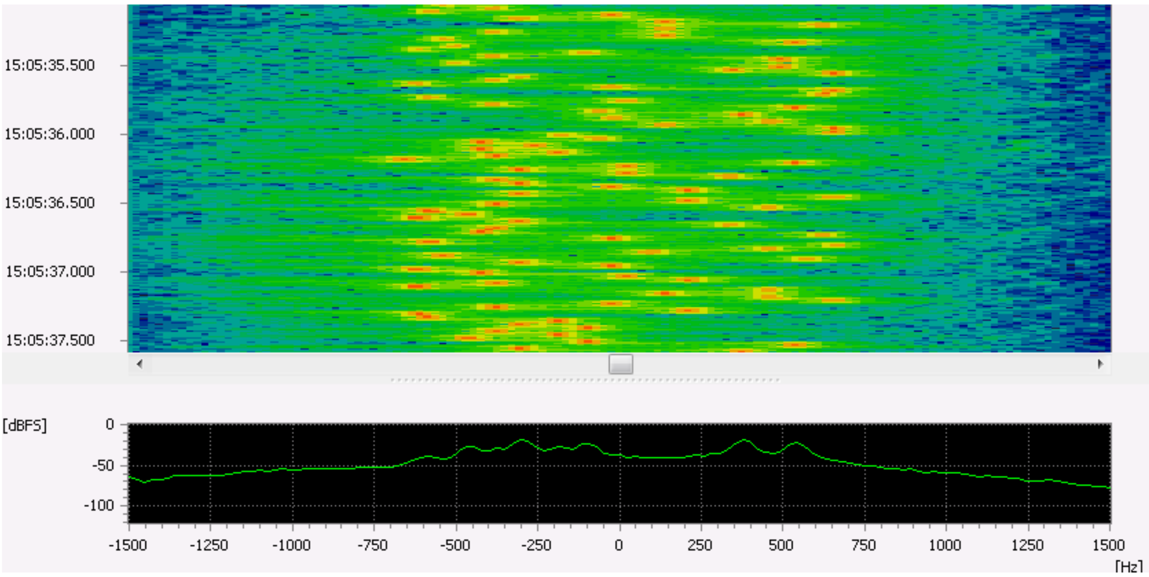


Figure 223: CIS-36 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	25
TD tolerance (ms)	2.5
No. of tones	36
Tone position type	Equidistant frequencies
Tone distance (Hz)	40
VER file name	*cis-36.ver*

Table 158: CIS-36 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 159: CIS-36 Features

CIS-36-50

General Information

CIS-36-50 is a modem used by the Soviet navy.
This modem system is also known as BEE or T600.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200 / 250 / 500
Bandwidth (Hz)	300 … 550
Symbol rate (Baud)	50
Encryption	

Table 160: CIS-36-50 Characteristics

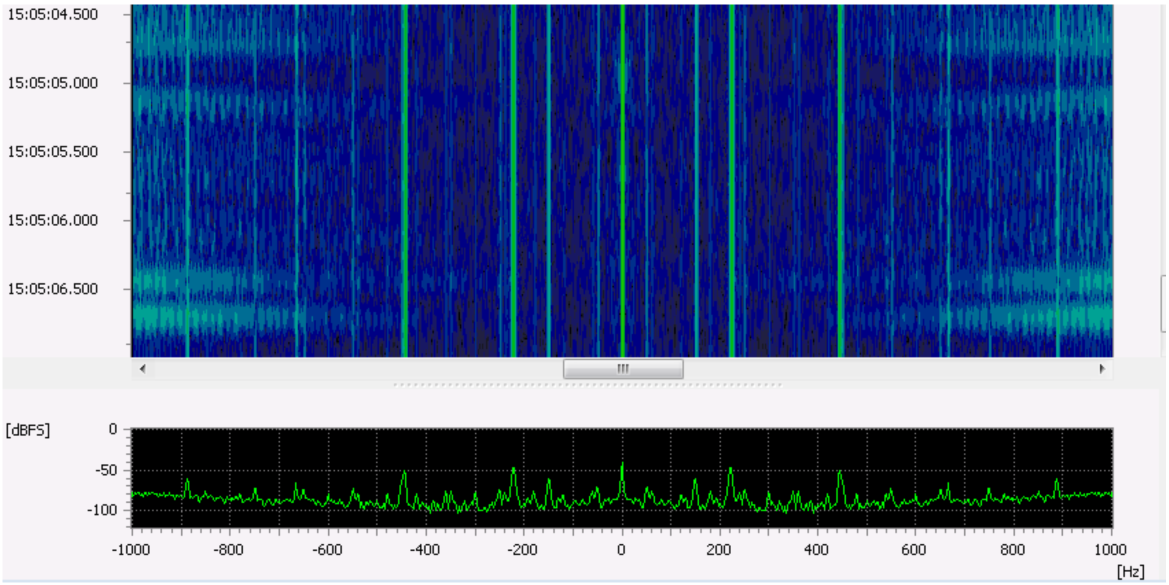


Figure 224: CIS-36-50 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	50
SR tolerance (Bd)	5
Shift (Hz)	250
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-36_50_50bd_250hz.ver*

Table 161: CIS-36-50 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding (raw output)	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 162: CIS-36-50 Features

CIS 405-3915

General Information

CIS 405-3915 is a synchronous teleprinter system in a CIS-8181 variant, but uses the half baud rate. This system is used by the Soviet military and railways authorities for point to point connections. Despite its simplicity this modem is still in operation today. Traffic is always encrypted. Sometimes operator chat or station id in Morse telegraphy can be copied.

Usage:

- Transfer of textual information over HF.
- Point-to-point communication between stations in CIS (Commonwealth of Independent States)-region.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Symbol rate (Baud)	40.5
Encryption	

Table 163: CIS 405-3915 Characteristics

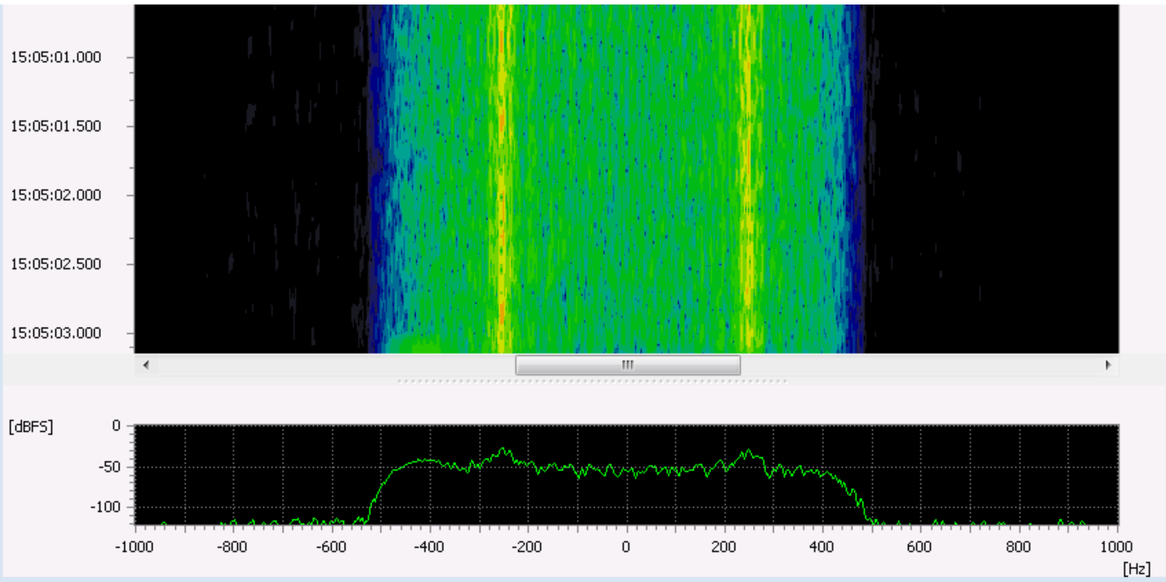


Figure 225: CIS 405-3915 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	40.5
SR tolerance (Bd)	5
Shift (Hz)	500
Shift tolerance (Hz)	10

Parameter	Default
Modem type	Synchronous
VER file name	*cis_405_3915.ver*

Table 164: CIS 405-3915 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 165: CIS 405-3915 Features

CIS-8181

General Information

CIS-8181 is a modem used by the Sovjet navy.
There is also a variant called CIS 8129.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Bandwidth (Hz)	600
Symbol rate (Baud)	81
Encryption	

Table 166: CIS-8181 Characteristics

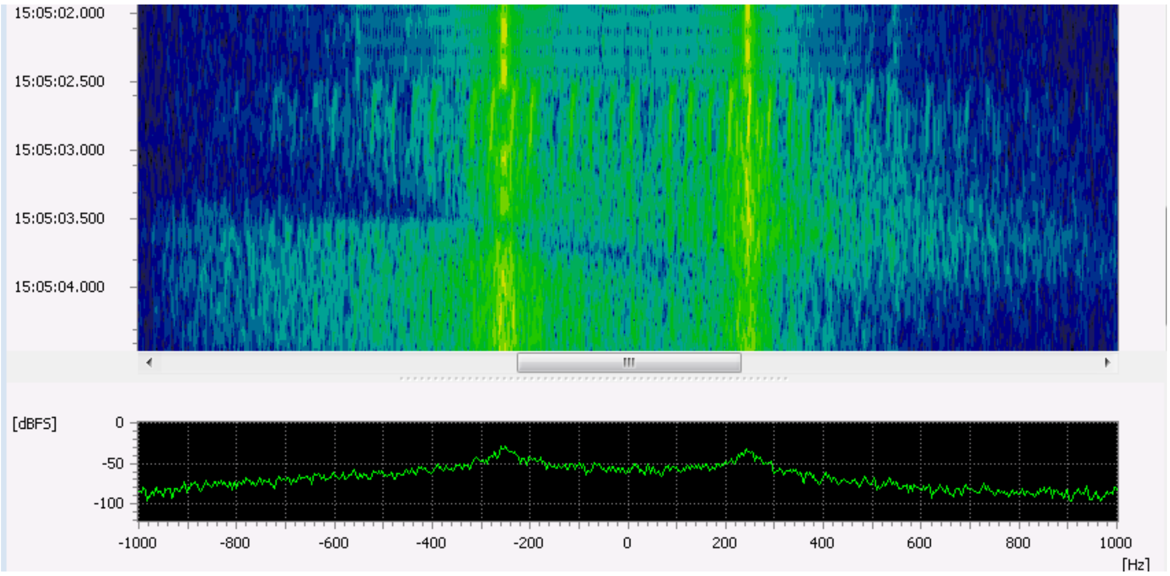


Figure 226: CIS-8181 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	81
SR tolerance (Bd)	5
Shift (Hz)	500
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*cis-81-81_81bd_500hz.ver*

Table 167: CIS-8181 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding (raw output)	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 168: CIS-8181 Features

Clover-II

General Information

Clover-II mode is a proprietary standard developed by HAL Communications Corp., USA.

Usage:

- ARQ and broadcast data communication over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK, DQPSK, 8-DPSK, 8P2A, 16P4A
Number of channels	4
Channel spacing (Hz)	125
Bandwidth (Hz)	500
Symbol rate (Baud)	31.25
Coding	Reed-Solomon

Table 169: Clover-II Characteristics

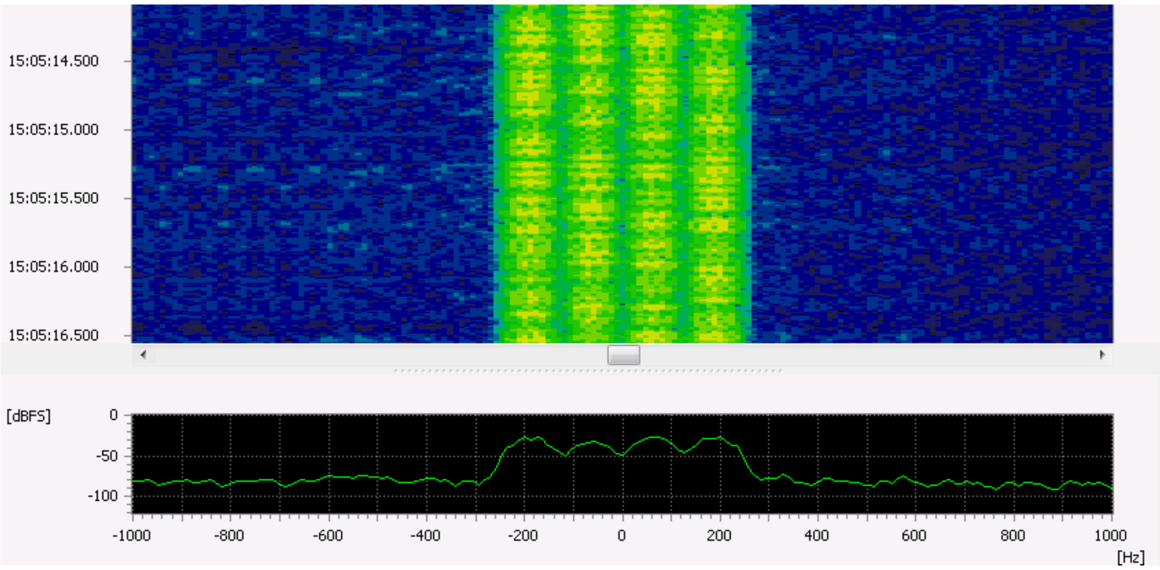


Figure 227: Clover-II Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Clover II
Modulation order	4
Min. burst length (s)	0.540
Max. burst length (s)	17.824
Min. pause length (s)	0.064
Min. burst SNR (dB)	0
VER file name	*clover_II.ver*

Table 170: Clover-II Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 171: Clover-II Features

Clover 2000

General Information

Clover 2000 mode is a standard developed by HAL Communications Corp., USA.
Clover 2500 is a version with identical modulation types and coding but increased bandwidth (2500 Hz) and symbol-rate.

Usage:

- ARQ and broadcast data communication over HF.

Mode Properties

Parameter	Value	
Modulation	DBPSK, DQPSK, 8-DPSK, 8P2A, 16P4A	
Number of channels	8	
Channel spacing (Hz)	250	312.5
Bandwidth (Hz)	2000	2500
Symbol rate (Baud)	62.5	78.125
Coding	Reed-Solomon	

Table 172: Clover 2000 / 2500 Characteristics

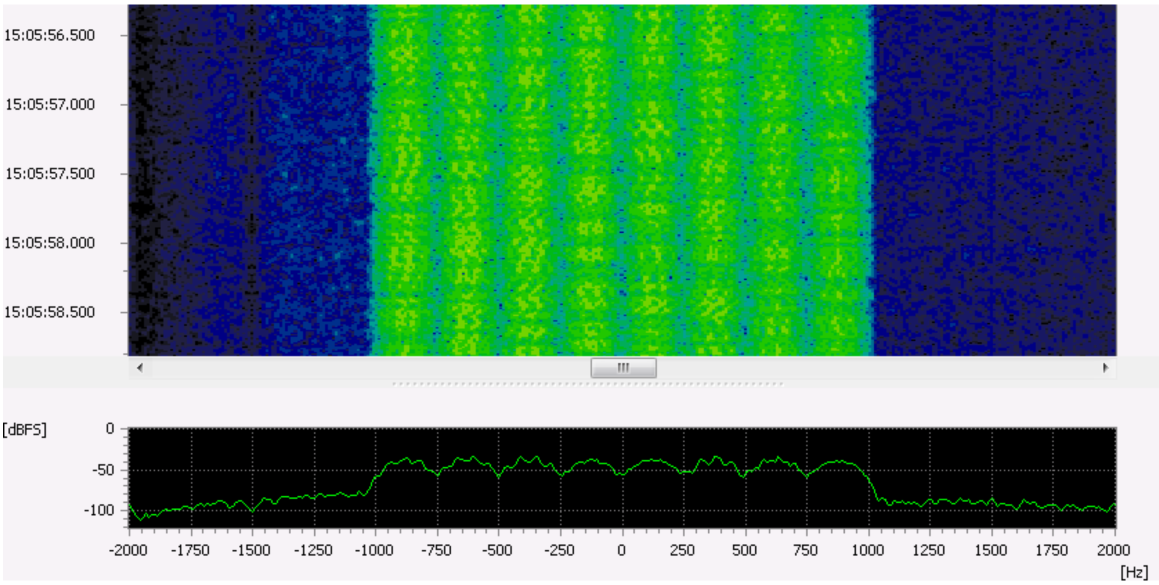


Figure 228: Clover 2000 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Clover 2000
Modulation order	64
Min. burst length (s)	0.270
Max. burst length (s)	4.400
Min. pause length (s)	0.040
Min. burst SNR (dB)	0
VER file name	*clover_2000.ver*

Table 173: Clover 2000 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 174: Clover 2000 / 2500 Features

Codan 3012

General Information

Codan 3012 mode is a proprietary standard developed by CODAN PTY Australia. Codan 3212 is similar to the Codan 3012 mode with same modulation parameters and slightly different encoding parameters. The Codan 3212 modem also supports decoding of the Codan 3012 mode.

Usage:

- ARQ and broadcast data communication over HF.
- ALE.

Mode Properties

Parameter	Value
Modulation	PSK
Number of tones	2
Number of channels	32
Channel spacing (Hz)	80
Bandwidth (Hz)	2560
Symbol rate (Bd)	80
Coding	Golay code

Table 175: Codan 3012 ALE Characteristics

Parameter	Value
TX modus	selective, broadcast, group call
Modulation	DPSK
Number of tones	4
Number of channels	4,8,12,16
Channel spacing (Hz)	112.5
Bandwidth (Hz)	1800
Symbol rate (Bd)	1200
Data rate (bit/s)	up to 6000
Alphabet	CCIR-476

Table 176: Codan 3012 Data Characteristics

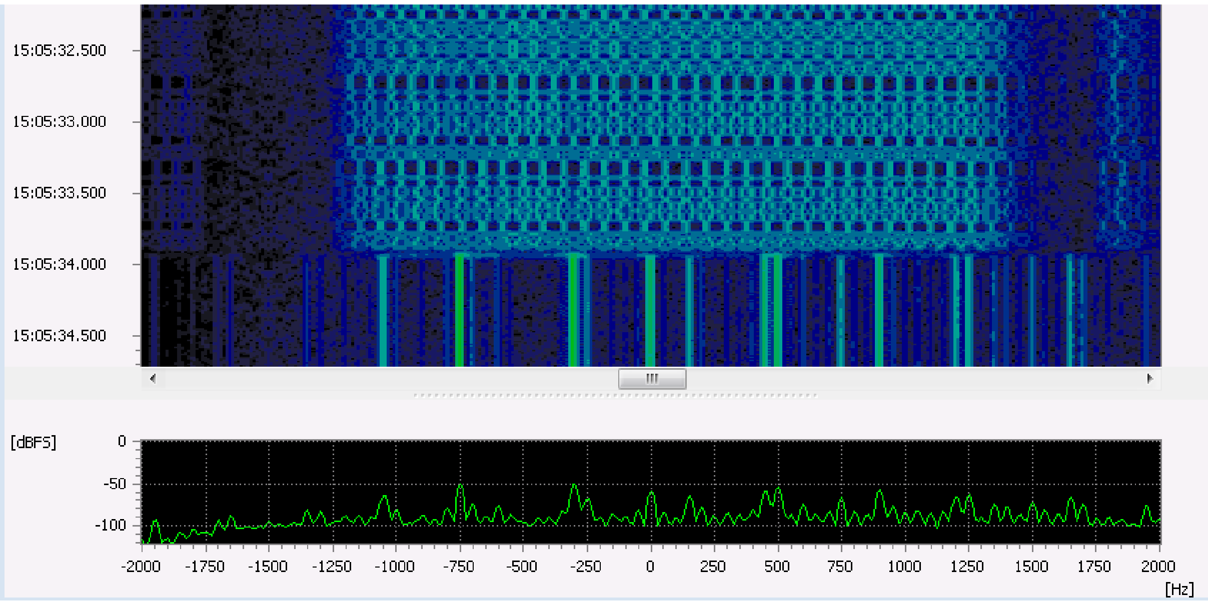


Figure 229: Codan 3012 ALE Spectrogram

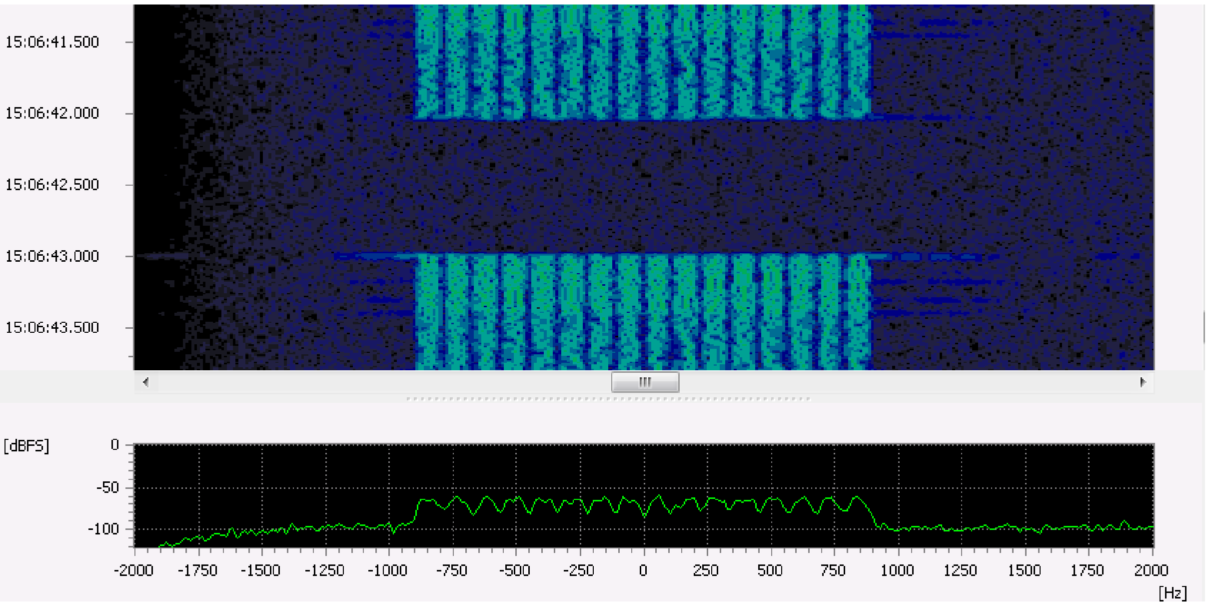


Figure 230: Codan 3012 Data Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Bd)	80
SR tolerance (Bd)	5
Modulation order	2
Version	A
No. of channels	32
Channel position type	Channel distance
Channel distance (Hz)	80

Parameter	Default
VER file name	*codanchirp.ver*

Table 177: Codan 3012 ALE Demodulator Settings

Parameter	Default
Demodulator	MDPSK 2,4,8,16 A/B
Symbol rate (Bd)	75
SR tolerance (Bd)	2
Modulation order	4
Version	A
No. of channels	16
Channel position type	Channel distance
Channel distance (Hz)	112.5
Min. burst length (s)	0.700
Max. burst length (s)	12.000
Min. pause length (s)	0.070
Min. burst SNR (dB)	9
VER file name	*codan3212_16channel_psk.ver*

Table 178: Codan 3012 Data Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 179: Codan 3012 Features

Codan Selcal

General Information

Codan SelCall FSK is a radio standard developed by CODAN PTY Australia.

Usage:

- Selcall and status message transfer over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2

Parameter	Value
Shift (Hz)	200
Bandwidth (Hz)	400
Symbol rate (Bd)	100
Coding	Parity checksum

Table 180: Codan Selcal ALE Characteristics

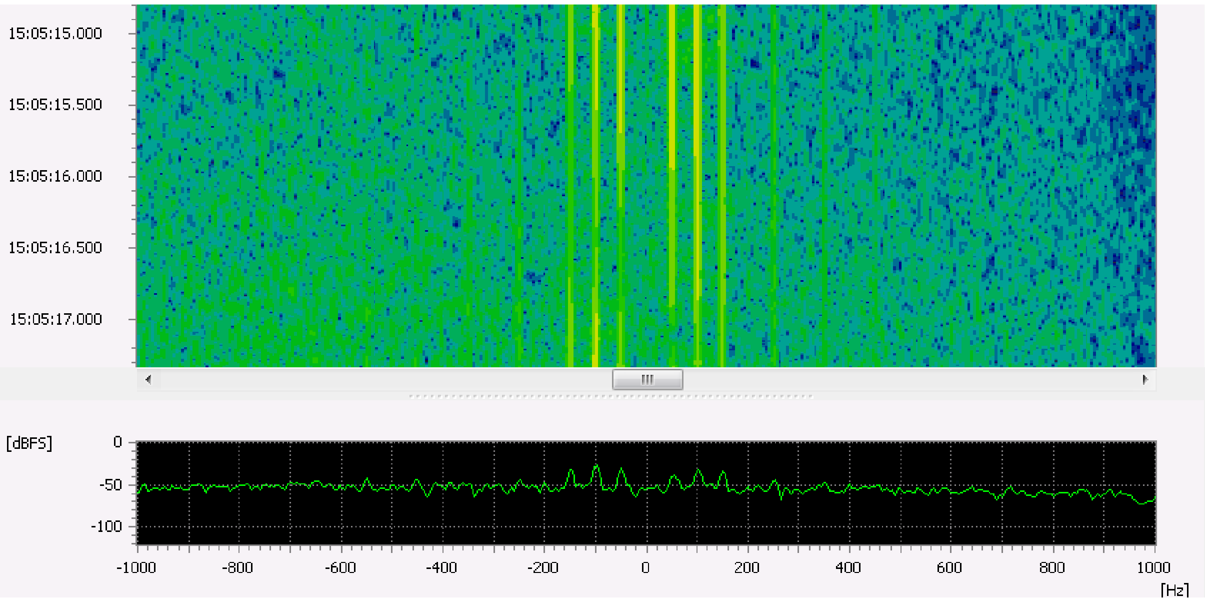


Figure 231: Codan Selcal Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*codan_selcall.ver*

Table 181: Codan Selcal Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes

Feature	Status
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 182: Codan Selcal Features

Coquelet-8

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Shift (Hz)	26.67
Bandwidth (Hz)	300
Symbol rate (Baud)	13.3 / 26.7
Alphabet	ITA-2 / ATU-80

Table 183: Coquelet-8 Characteristics

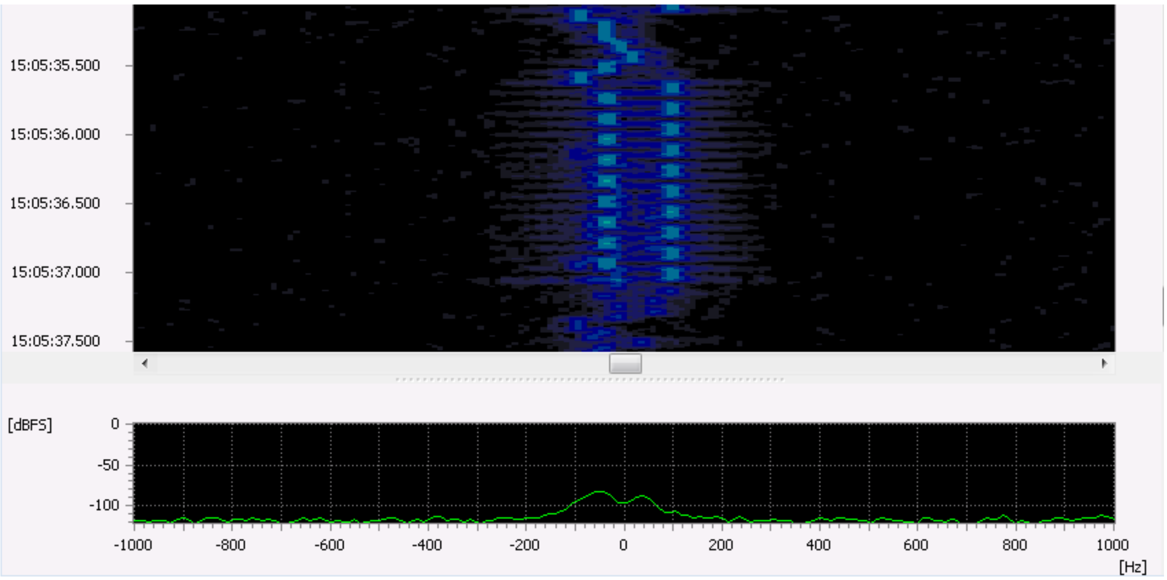


Figure 232: Coquelet-8 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Coquelet
Tone duration (ms)	37.5

Parameter	Default
TD tolerance (ms)	2
No. of tones	8
Tone distance (Hz)	26.67
VER file name	*coquelet-8.ver*

Table 184: Coquelet-8 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 185: Coquelet-8 Features

Coquelet-13

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	13
Shift (Hz)	30
Bandwidth (Hz)	500
Symbol rate (Baud)	13.3 / 20.0
Alphabet	ITA-2 / ATU-80

Table 186: Coquelet-13 Characteristics

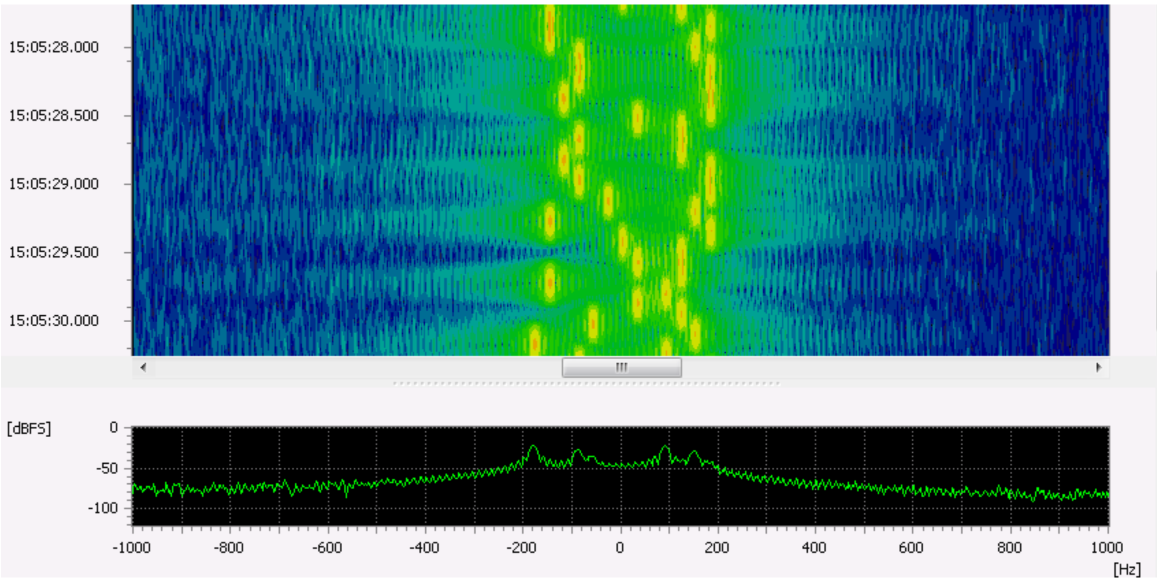


Figure 233: Coquelet-13 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	75
TD tolerance (ms)	1
No. of tones	13
Tone position type	Equidistant frequencies
Tone distance (Hz)	30
VER file name	*coquelet-13_75ms.ver*

Table 187: Coquelet-13 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 188: Coquelet-13 Features

Coquelet-80

General Information

The Coquelet modes were designed for the communications of French customs and police authorities. They are similar to the British Piccolo modes.
Coquelet-80 is the extension of Coquelet-8 by FEC.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	8
Shift (Hz)	26.67
Bandwidth (Hz)	300
Symbol rate (Baud)	13.3 / 26.7
Alphabet	ITA-2 / ATU-80

Table 189: Coquelet-80 Characteristics

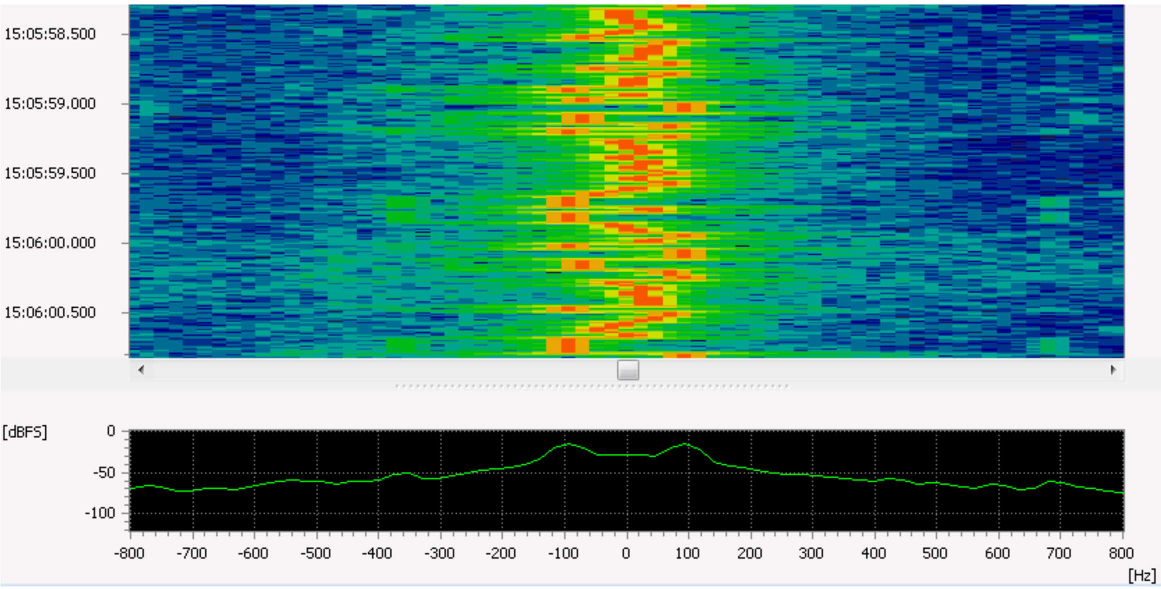


Figure 234: Coquelet-80 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Coquelet
Tone duration (ms)	37.5
TD tolerance (ms)	2
No. of tones	8
Tone spacing (Hz)	26.67
VER file name	*coquelet-80.ver*

Table 190: Coquelet-80 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 191: Coquelet-80 Features

DGPS

General Information

DGPS is a radio standard for transmission of corrections to the satellite ranging measurements (GPS and GLONASS). This radio standard is based on the recommendations of the RTCM Special Committee 104 (SC-104).

Usage:

- Transmission of differential correction signals.

Mode Properties

Parameter	Value
Modulation	MSK / QPSK
Symbol rate (Baud)	100 / 300
Coding	Parity checksum, CRC

Table 192: DGPS Characteristics

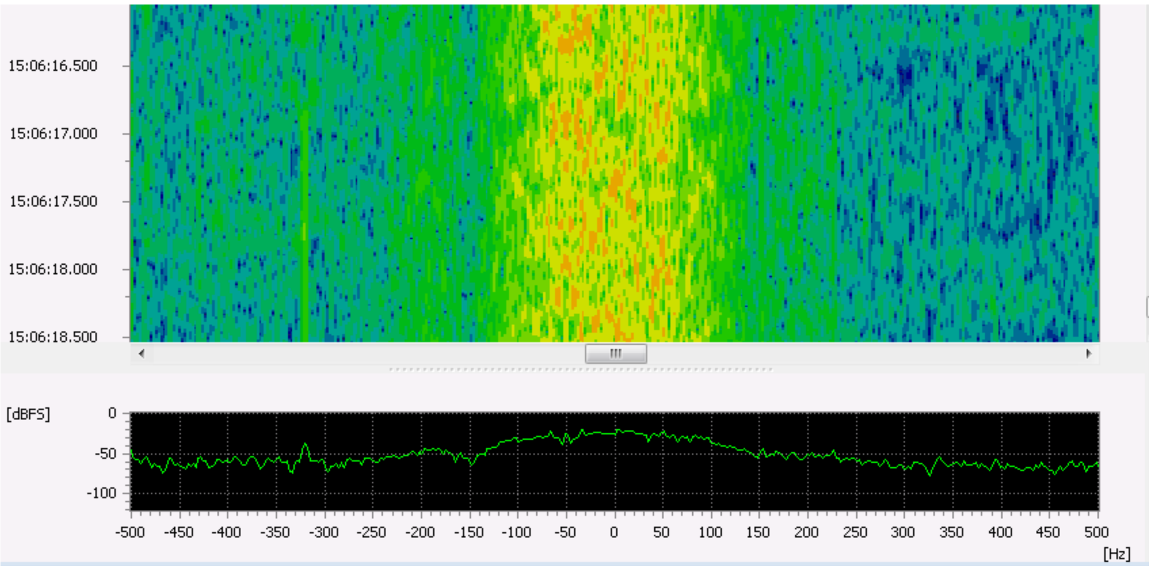


Figure 235: DGPS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK.
Type	MSK
Symbol rate (Bd)	200
SR tolerance (Bd)	10
VER file name	*dgps_200bd_msk.ver*

Table 193: DGPS Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 194: DGPS Features

DSC

General Information

DSC (**D**igital **S**elective **C**alling) is part of the GMDSS (Global Maritime Distress and Safety System). It provides automatically formatted distress alerts, urgency, safety and routine radio-telephone calls.

Usage:

- Data communication over HF / VHF.
- Initiation of radiotelephone and MF/HF radiotelex calls.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	500
Symbol rate (Baud)	100
Coding	Checksum

Table 195: DSC HF Characteristics

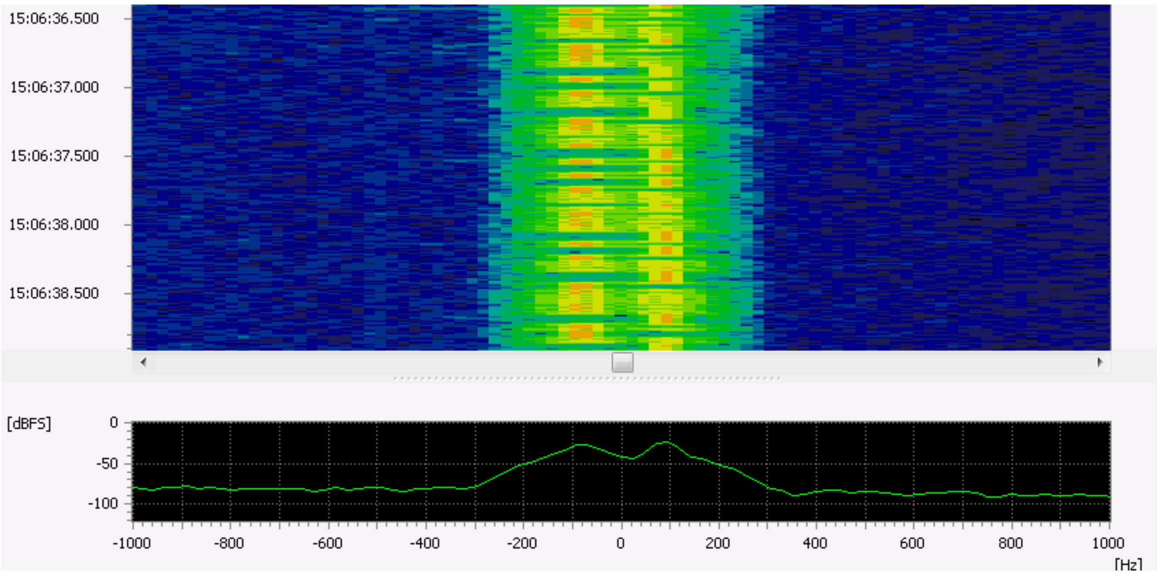


Figure 236: DSC HF Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	10
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*dsc-hf.ver*

Table 196: DSC HF Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment HF	no
Combination with other modems (modem list)	yes

Table 197: DSC Features

DUP-ARQ

General Information

DUP-ARQ is a synchronous duplex teleprinter system with ARQ. This modem was used by the Ministry of Foreign Affairs in Hungary.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Symbol rate (Baud)	125
Coding	7 bit parity
Alphabet	ITA-2

Table 198: DUP-ARQ Characteristics

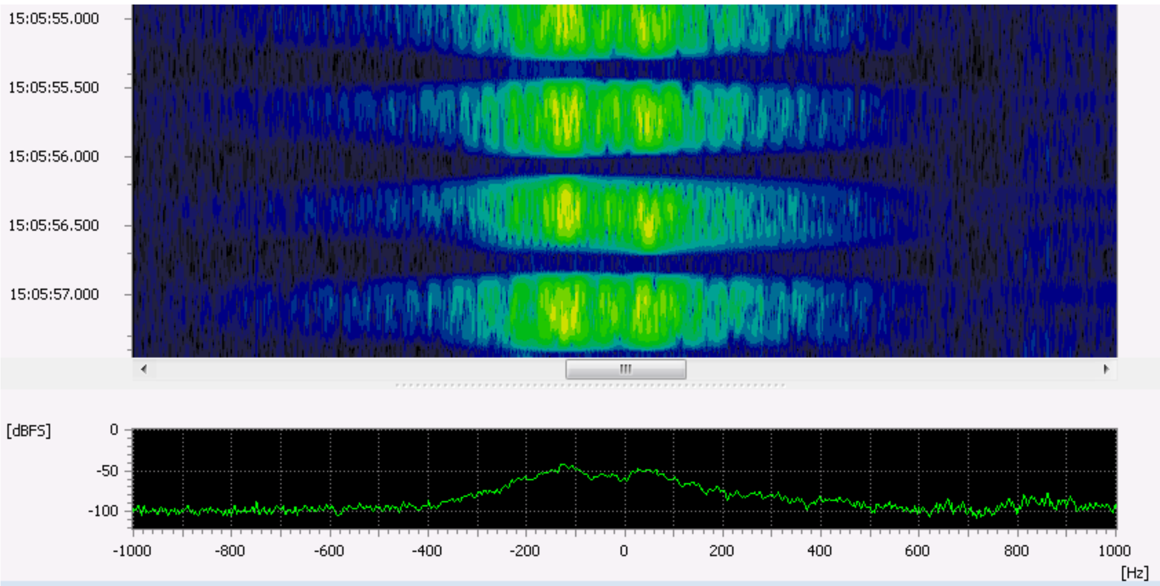


Figure 237: DUP-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	125
SR tolerance (Bd)	0.1
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.245

Parameter	Default
Max. burst length (s)	0.280
Min. pause length (s)	0.260
VER file name	*dup-arq_125bd_170hz.ver*

Table 199: DUP-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 200: DUP-ARQ Features

FEC-A

General Information

FEC-A is a synchronous FEC system. This system was mainly used for military and diplomatic services as well as for news agencies.
This modem system is also known as FEC-100(A).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	850
Bandwidth (Hz)	1200
Symbol rate (Baud)	144
Error correction	Convolutional coding
Alphabet	ITA-2

Table 201: FEC-A Characteristics

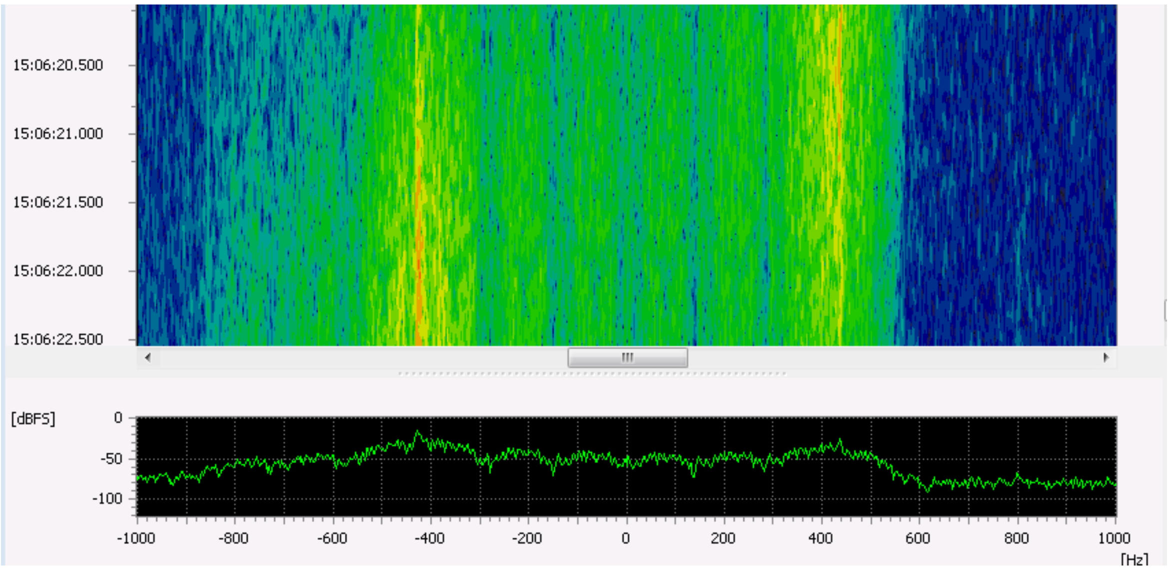


Figure 238: FEC-A Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	145
SR tolerance (Bd)	5
Shift (Hz)	850
Shift tolerance (Hz)	50
Modem type	Synchronous
VER file name	*fec-a_145bd_850hz.ver*

Table 202: FEC-A Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 203: FEC-A Features

FSK 400/500

General Information

FSK 400/500 is a chinese multi-tone modem.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	4
Tone spacing (Hz)	400 / 500
Bandwidth (Hz)	500 / 600
Symbol rate (Bd)	100

Table 204: FSK 400/500 Characteristics

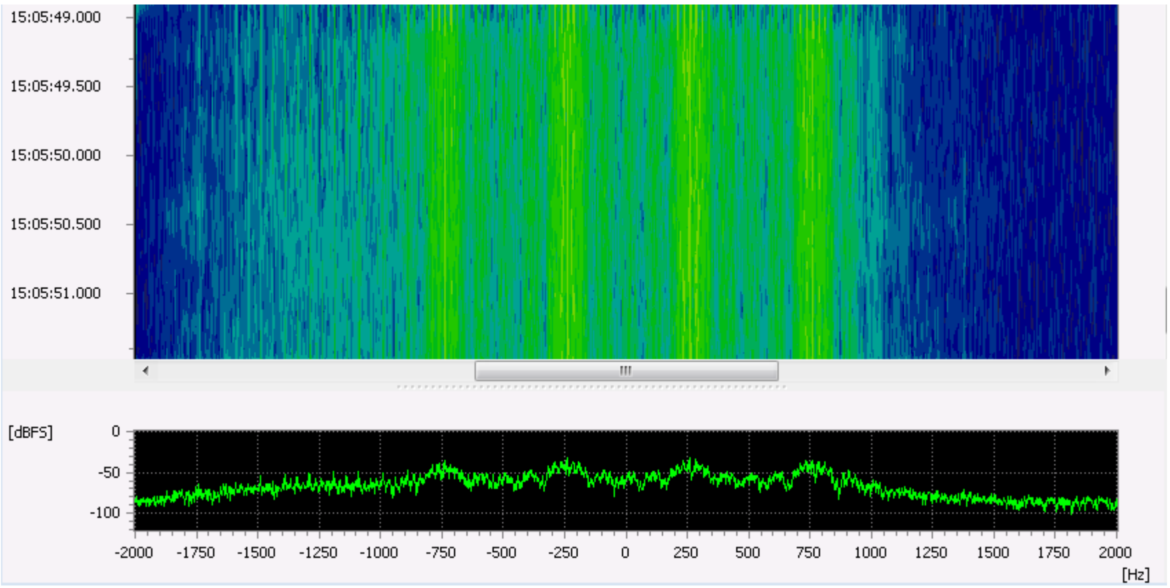


Figure 239: FSK 400/500 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	10
TD tolerance (ms)	0.5
No. of tones	4
Tone position type	Equidistant frequencies
Tone distance (Hz)	500
Min. burst length (s)	2.500
Max. burst length (s)	3.200
Min. pause length (s)	1.000
VER file name	*fsk_400_500.ver*

Table 205: FSK 400/500 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 206: FSK 400/500 Features

Globe Wireless FSK

General Information

Globe Wireless FSK is one of several radio modems used by the Globe Wireless company in the HF-frequency band.

Usage:

- Transfer of selcall and status messages over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	300
Symbol rate (Bd)	100
Error correction	Parity checksum

Table 207: Globe Wireless FSK Characteristics

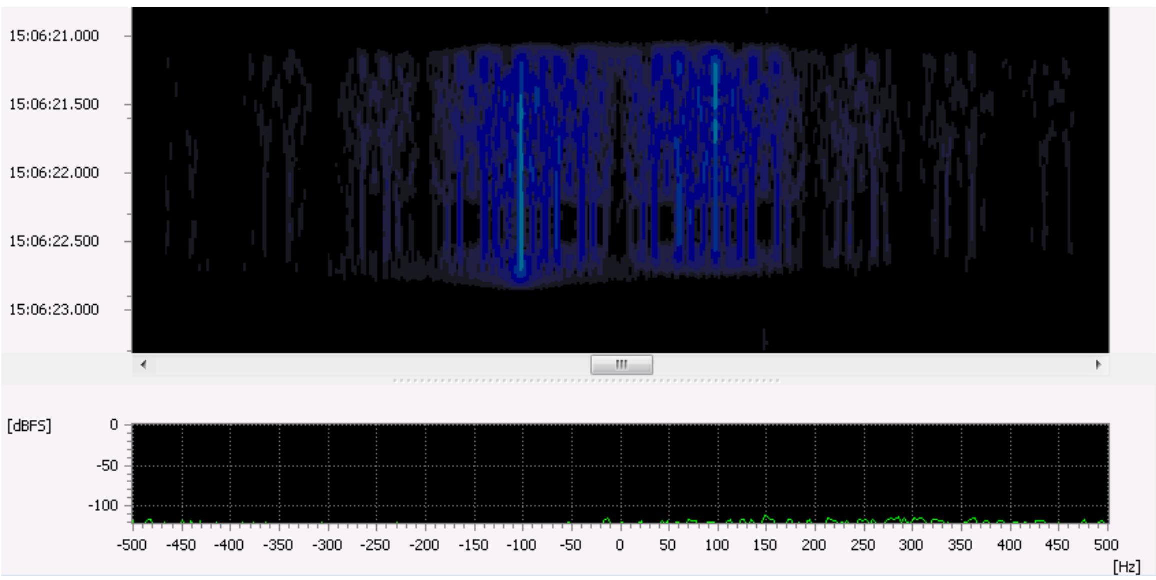


Figure 240: Globe Wireless FSK Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	10
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.700
Max. burst length (s)	1.700
Min. pause length (s)	0.120
VER file name	*gw_fsk_100bd_200hz.ver*

Table 208: Globe Wireless FSK Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 209: Globe Wireless FSK Features

Globe Wireless PSK

General Information

Globe Wireless PSK is one of several radio modems used by the Globe Wireless company in the HF-frequency band.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	DQPSK
Bandwidth (Hz)	400
Symbol rate (Bd)	200

Table 210: Globe Wireless PSK Characteristics

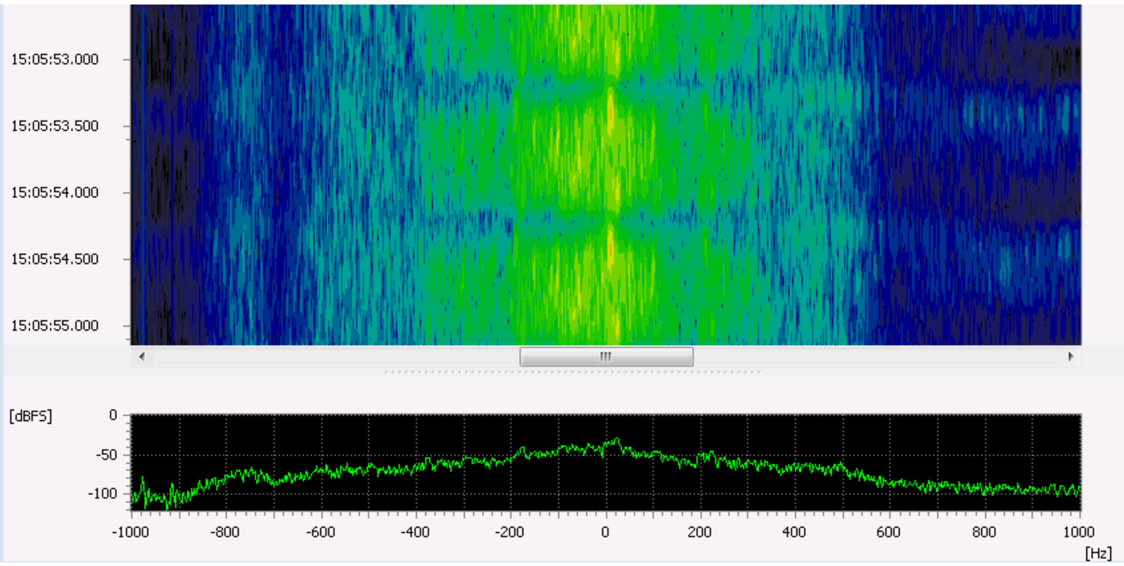


Figure 241: Globe Wireless PSK Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Modulation order	4
Version	A
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	0
VER file name	*gw_psk_200bd_psk4.ver*

Table 211: Globe Wireless PSK Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 212: Globe Wireless PSK Features

G-TOR

General Information

G-TOR mode is a proprietary standard developed by Kantronics Inc. and is used by radio amateurs, military (Irish Air Corps/Navy, Mexican army) and governmental agencies (ICRC).

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Symbol rate (Bd)	100 / 200 / 300
Coding	Golay code, Interleaving, CRC
Alphabet	ITA-5

Table 213: G-TOR Characteristics

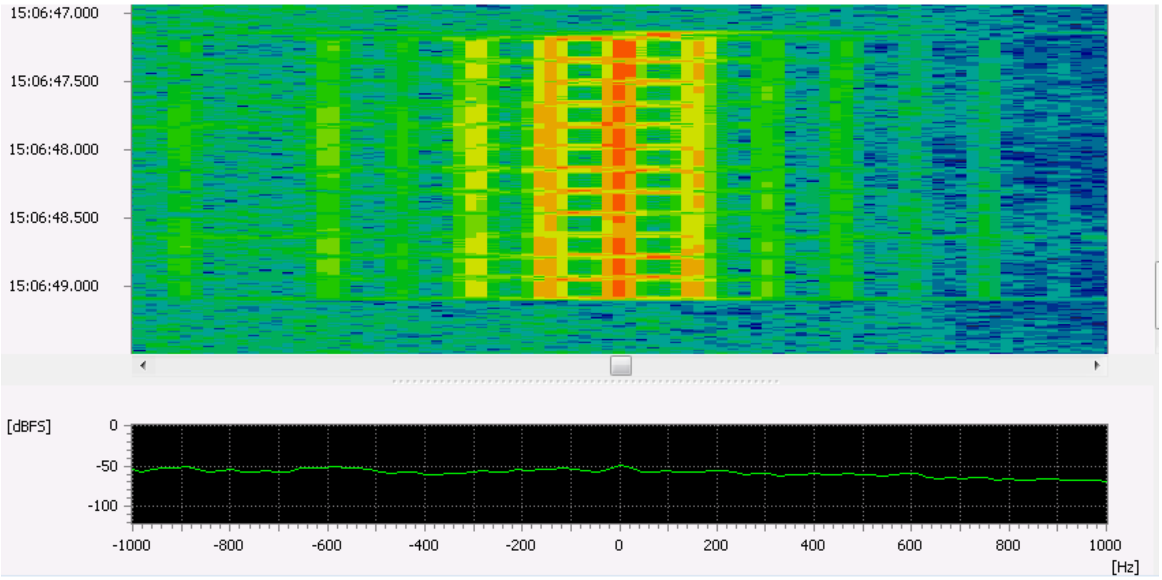


Figure 242: G-TOR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	300
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	180
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.080

Parameter	Default
Max. burst length (s)	2.000
Min. pause length (s)	0.080
VER file name	g-tor_300bd_180hz.ver

Table 214: G-TOR Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 215: G-TOR Features

HFDL

General Information

The High Frequency Data Link HFDL (ARINC Report 635-3) is used in civil long distance aircraft communications between aircrafts and a cluster of ground stations.

Usage:

- Aeronautical information exchange over HF.

Mode Properties

Parameter	Value
Modulation	PSK2/4/8
Bandwidth (Hz)	400
Symbol rate (Bd)	1800
Error correction	ARQ
Data rate (bps)	300 / 600 / 1200 /1800

Table 216: HFDL Characteristics

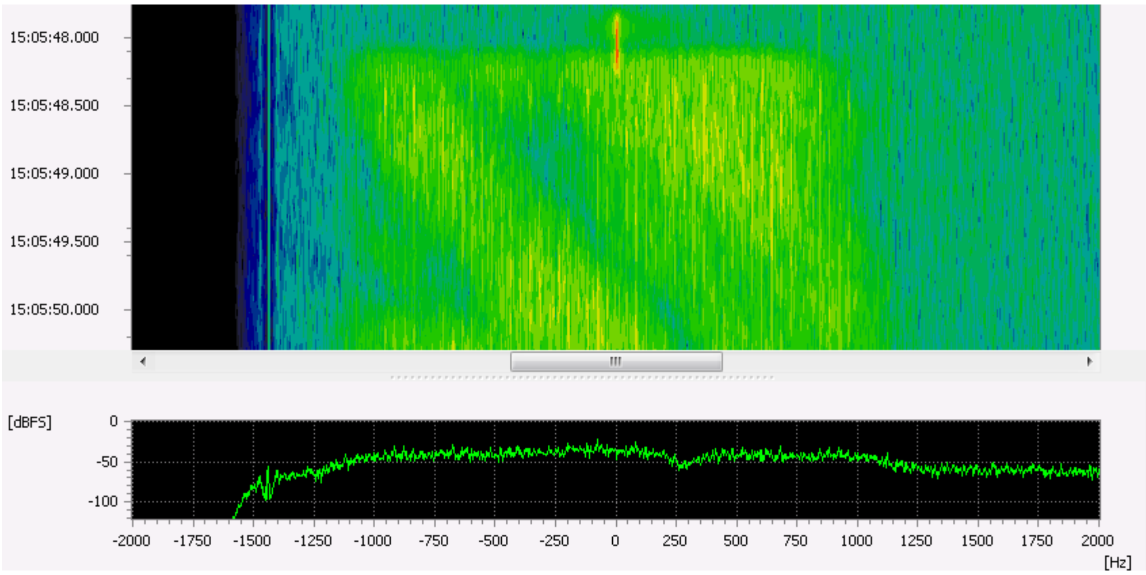


Figure 243: HFDL Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	PSK data added
Symbol rate (Bd)	1800
SR tolerance (Bd)	9
Modulation order	2
Shift (Hz)	170
Min. burst length (s)	2.100
Max. burst length (s)	5.000
Min. pause length (s)	0.010
VER file name	hfdl_psk2.ver

Table 217: HFDL Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	no
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 218: HFDL Features

HNG-FEC

General Information

HNG-FEC is a full duplex system used by the Ministry of Foreign Affairs in Hungary.
This modem is not used any more.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	500
Symbol rate (Bd)	100.5
Coding	Interleaving, Parity bits
Alphabet	ITA-2

Table 219: HNG-FEC Characteristics

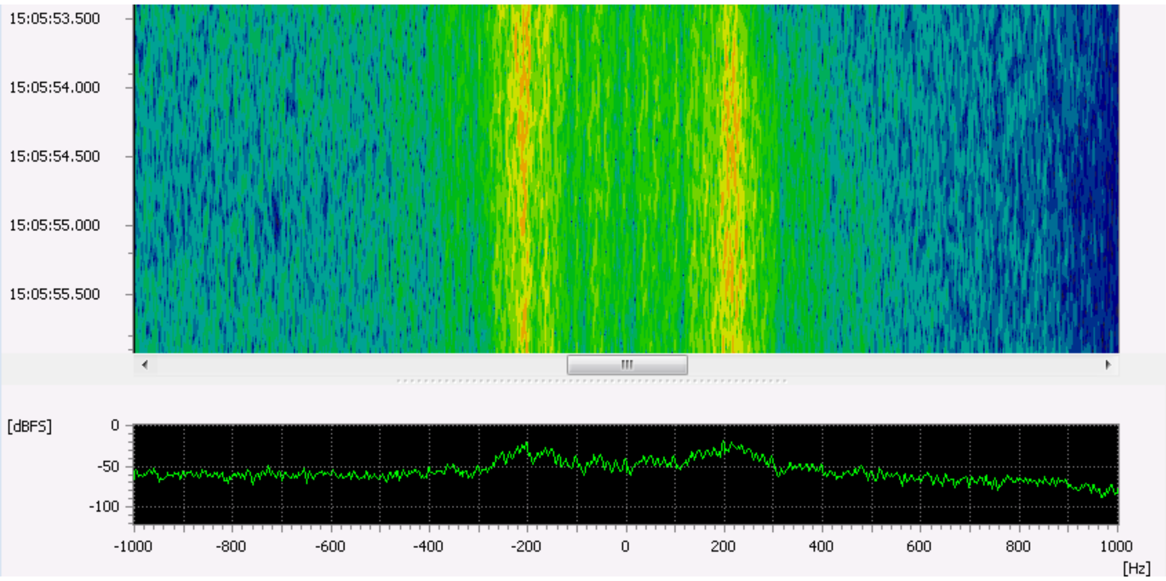


Figure 244: HNG-FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	420
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*hng_fec.ver*

Table 220: HNG-FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 221: HNG-FEC Features

MD674

General Information

MD674 is a military asynchronous FSK modem.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Symbol rate (Bd)	50 … 150
Error correction	ARQ
Alphabet	ITA-2 / ITA-5

Table 222: MD674 Characteristics

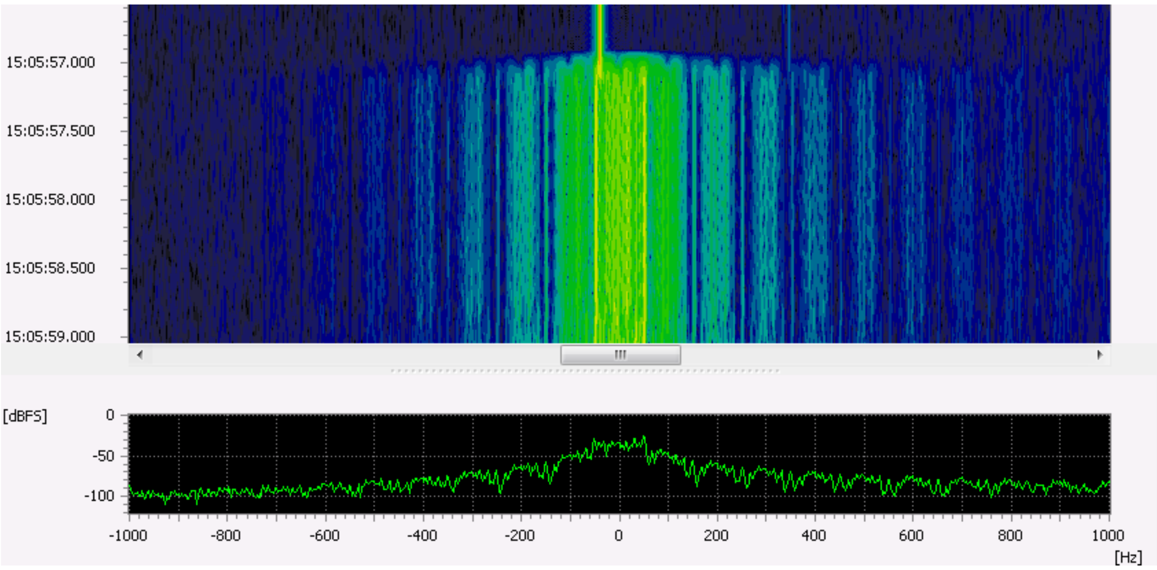


Figure 245: MD674 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	85
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	md647.ver

Table 223: MD674 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 224: MD674 Features

MEROD

General Information

MEROD is a Message Entry and Read-Out Device for exchange of encrypted tactical messages over a radio channel in burst mode.

Usage:

- Exchange of tactical information over HF with emissions of minimum length.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	810
Bandwidth (Hz)	1200
Symbol rate (Bd)	266
Error correction	BCH(127,78)
Alphabet	MEROD specific 6 bit

Table 225: MEROD Characteristics

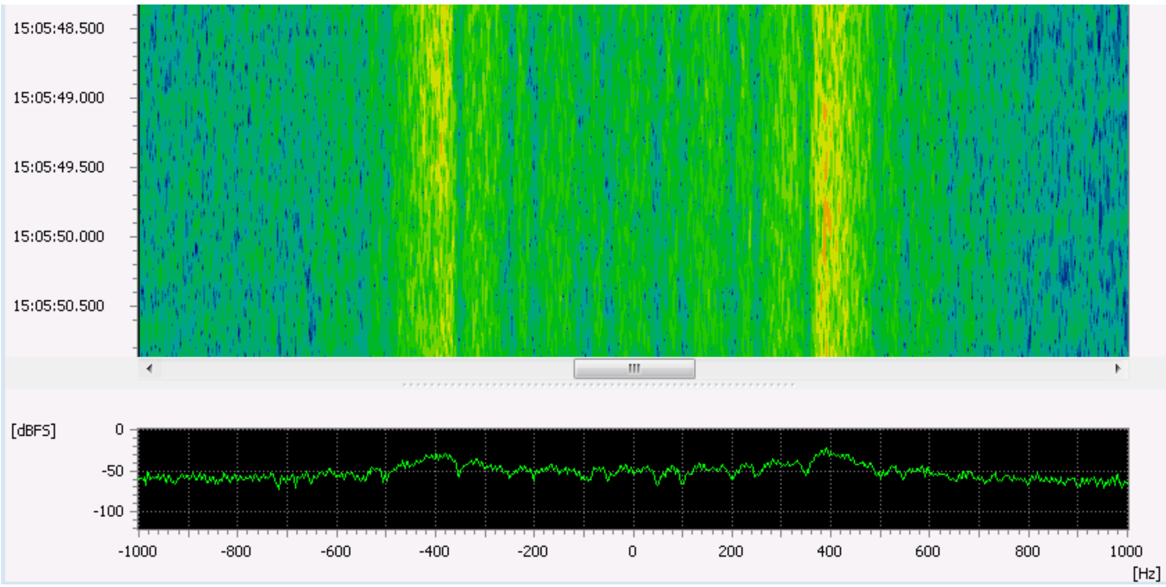


Figure 246: MEROD Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	150
SR tolerance (Bd)	5
Shift (Hz)	810
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*merod.ver*

Table 226: MEROD Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 227: MEROD Features

MFSK8

General Information

MFSK8 is a mode for digital data communication in the amateur radio domain.

Usage:

- Transfer of textual information by radio amateurs over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	32
Tone spacing (Hz)	7.8125
Bandwidth (Hz)	330
Symbol rate (Bd)	7.8125
Error correction	FEC

Table 228: MFSK8 Characteristics

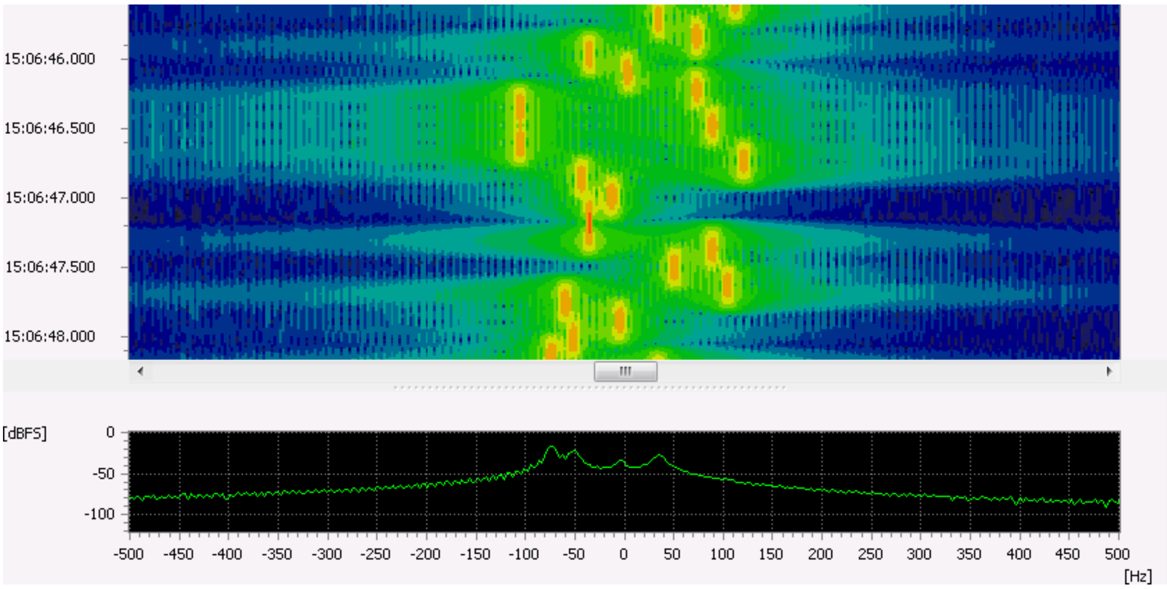


Figure 247: MFSK8 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	128
TD tolerance (ms)	0
No. of tones	32
Tone position type	Equidistant frequencies
Tone distance (Hz)	7.813
VER file name	mfsk-8.ver

Table 229: MFSK8 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 230: MFSK8 Features

MFSK16

General Information

MFSK16 is a mode for digital data communication in the amateur radio domain.

Usage:

- Transfer of textual information by radio amateurs over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	16
Tone spacing (Hz)	15.625
Bandwidth (Hz)	330
Symbol rate (Bd)	15.625
Error correction	FEC

Table 231: MFSK16 Characteristics

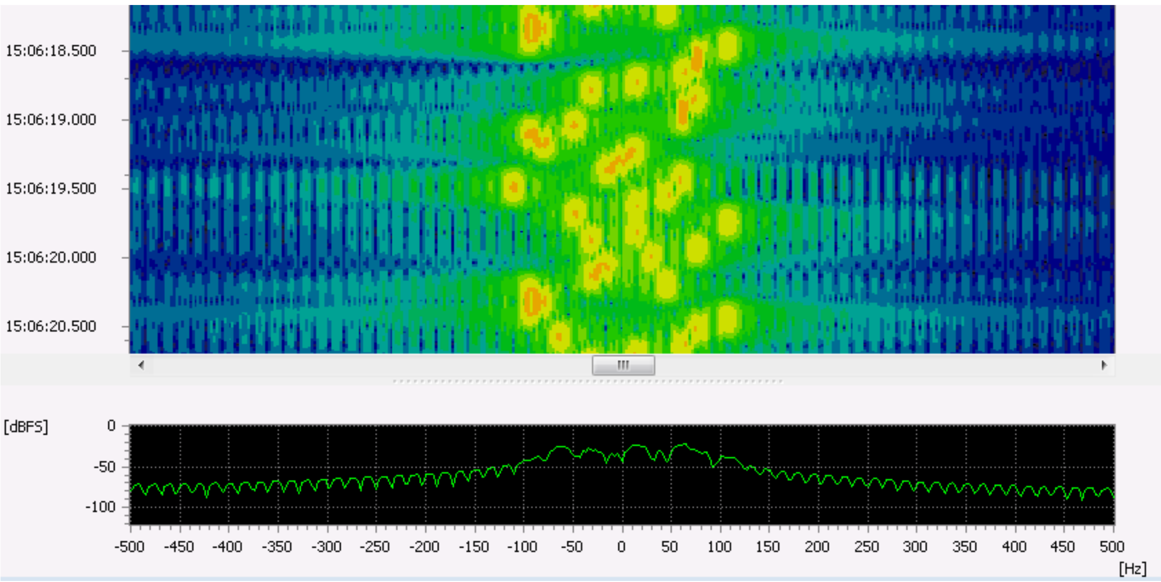


Figure 248: MFSK16 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	64
TD tolerance (ms)	0.3
No. of tones	16
Tone position type	Equidistant frequencies
Tone distance (Hz)	15.625
VER file name	*mfsk-16.ver*

Table 232: MFSK16 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 233: MFSK16 Features

Morse

General Information

Morse code was the first method for data transfer over radio. By now it has been mostly replaced by digital modes.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	Carrier keyed on/off
Bandwidth (Hz)	400
Symbol rate (Bd)	Depending on data-rate
Data rate (cpm)	30 … 300

Table 234: Morse Characteristics

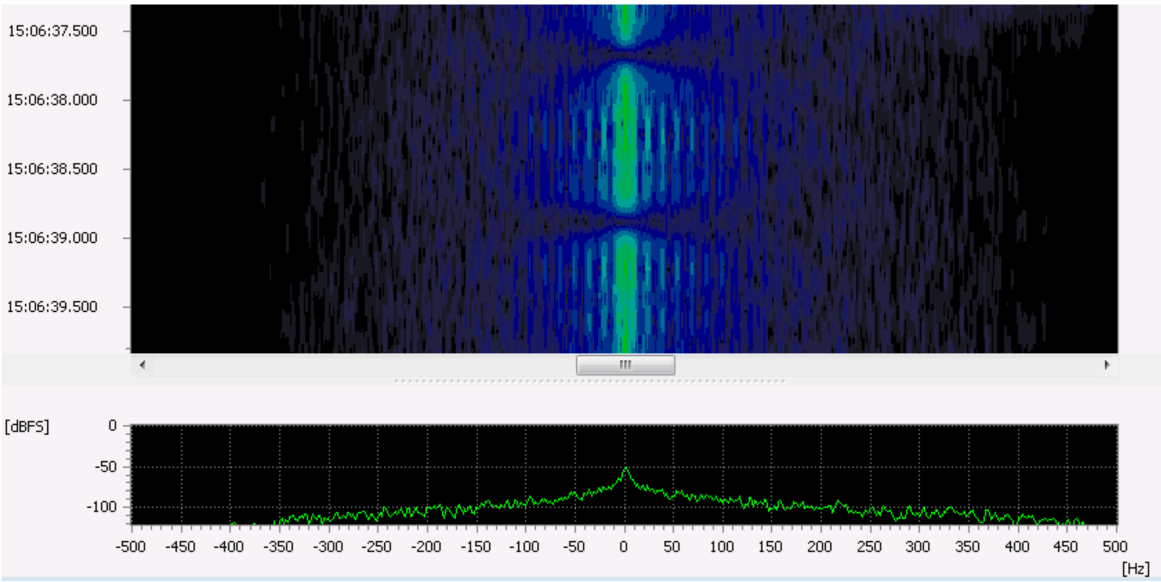


Figure 249: Morse Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Morse
Range (cpm)	60…125
Keying rate (cpm)	250
Tolerance (cpm)	250
VER file name	morse_raw.ver

Table 235: Morse Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 236: Morse Features

Olivia

General Information

Olivia is a radio teletype modem developed by radio amateur Pawel Jalocha.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	MFSK
Number of tones	4/8/16/32
Shift (Hz)	200
Symbol rate (Bd)	31.25
Coding	Walsh
Alphabet	ITA-5

Table 237: Olivia Characteristics

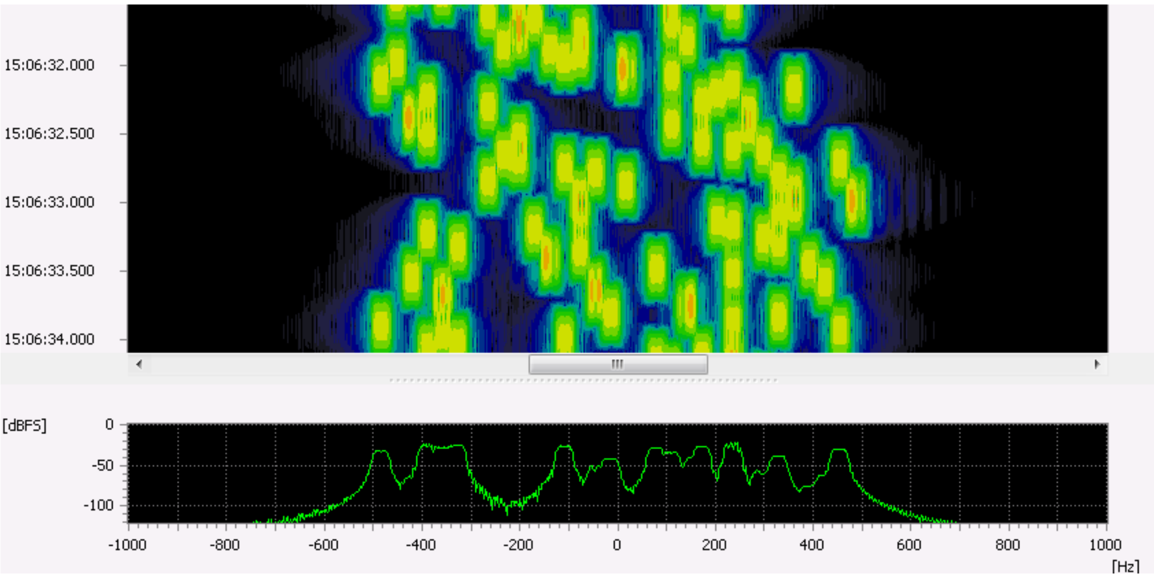


Figure 250: Olivia Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	32
TD tolerance (ms)	4
No. of tones	32
Tone position type	Equidistant frequencies
Tone distance (Hz)	31.25
VER file name	*olivia-1000-32.ver*

Table 238: Olivia Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes

Feature	Status
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 239: Olivia Features

Packet 300

General Information

Packet radio is a complex data transmission system used by radio amateurs. Packet radio networks use the AX.25 data link layer protocol, derived from the X.25 protocol suite and designed for amateur radio use.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	500
Symbol rate (Bd)	500
Coding	NRZ

Table 240: Packet 300 Characteristics

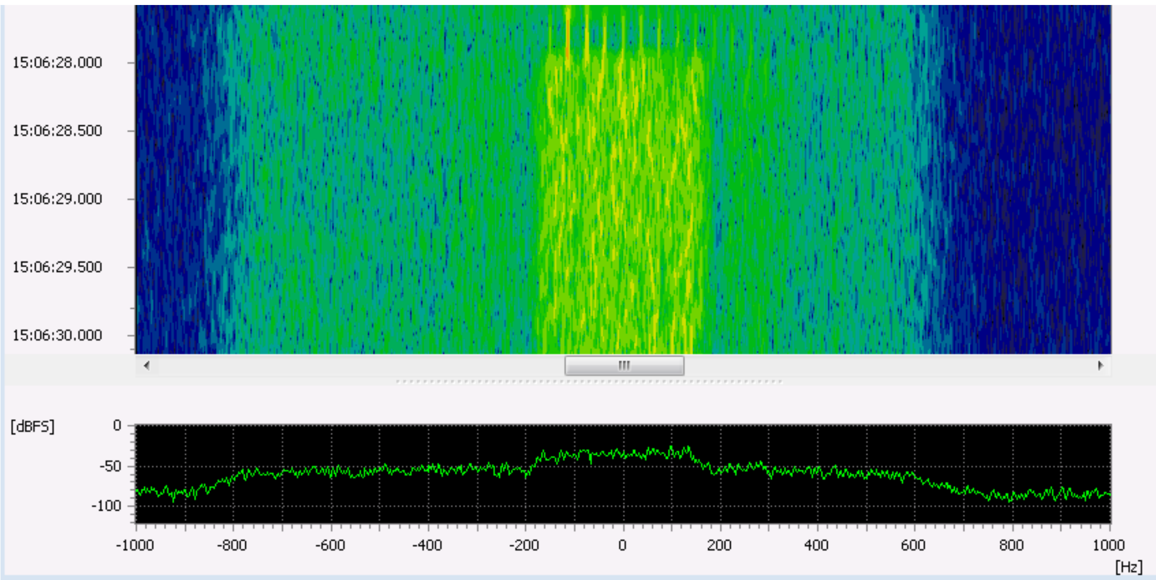


Figure 251: Packet 300 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	300
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.500
Max. burst length (s)	10.000
Min. pause length (s)	0.180
VER file name	packet-300-4800.ver

Table 241: Packet 300 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 242: Packet 300 Features

PACTOR I

General Information

Pactor-I mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.

Usage:

- Data communication over HF.
- In successive standards Pactor-II and Pactor-III the mode Pactor-I is used during the call set-up.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Bandwidth (Hz)	300
Symbol rate (Bd)	100 / 200
Coding	Huffman code

Table 243: PACTOR I Characteristics

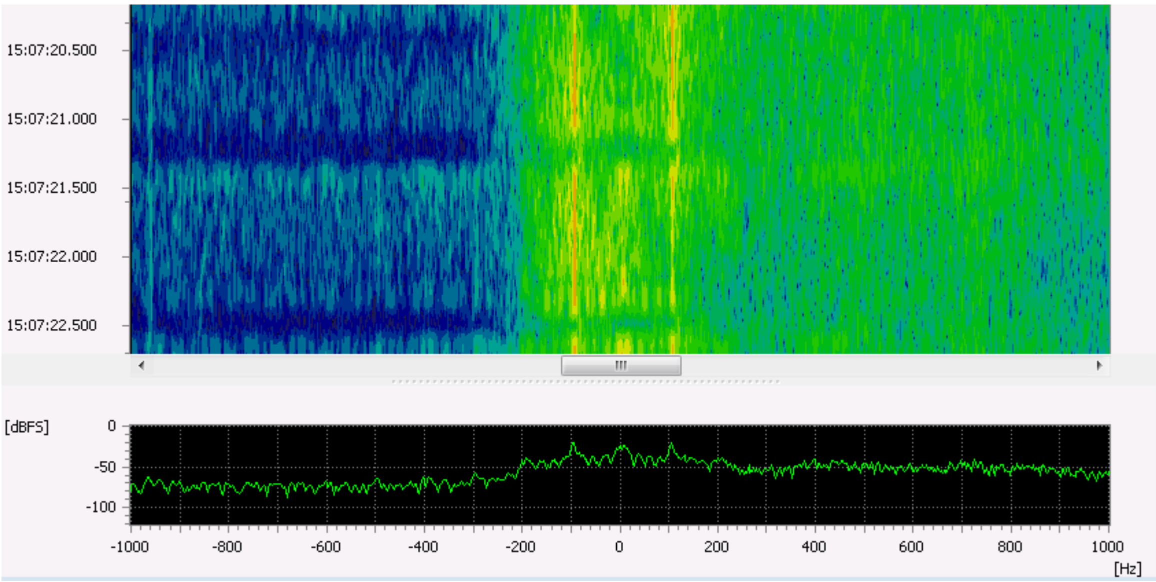


Figure 252: PACTOR I Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	5
Shift (Hz)	200
Shift tolerance (Hz)	10
Modem type	Multiple SR
Min. burst length (s)	0.120
Max. burst length (s)	1.000
Min. pause length (s)	0.170
VER file name	*pactor_i.ver*

Table 244: PACTOR I Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 245: PACTOR I Features

PACTOR I FEC

General Information

Pactor-I mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany.
The FEC/Unproto variant is used for broadcast transmissions.

Usage:

- Broadcast data transmissions over HF.
- During call set-up Pactor-I-FEC mode is used.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	200
Symbol rate (Bd)	100 / 200
Coding	Huffman code, CRC

Table 246: PACTOR I FEC Characteristics

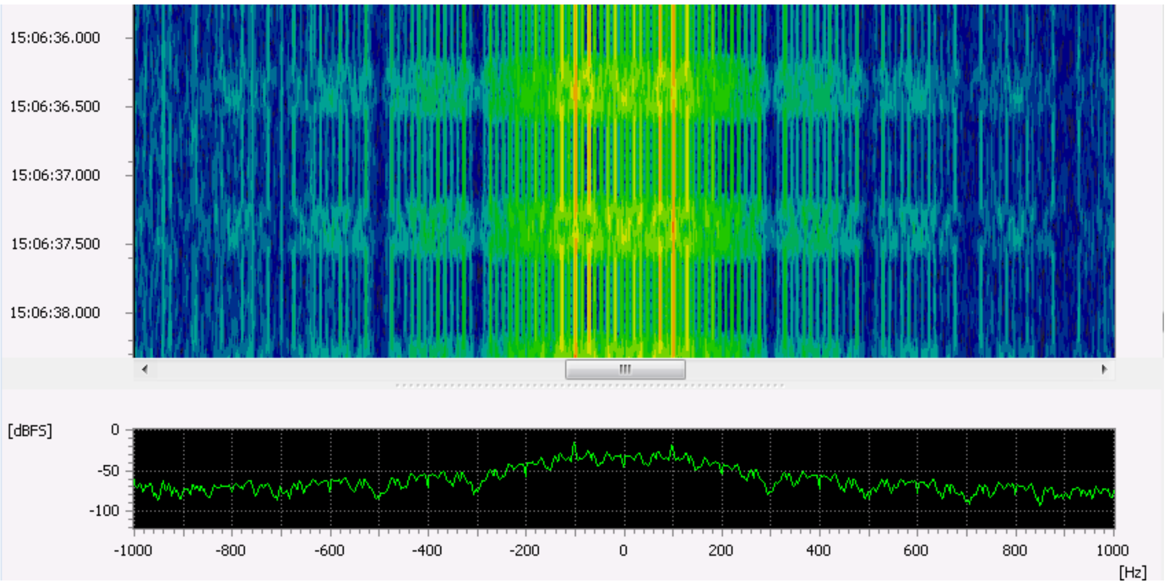


Figure 253: PACTOR I FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	200
SR tolerance (Bd)	1
Shift (Hz)	200
Shift tolerance (Hz)	20
Modem type	Multiple SR
VER file name	*pactor_i_fec.ver*

Table 247: PACTOR I FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 248: PACTOR I FEC Features

PACTOR II

General Information

Pactor-II mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany. It is an advancement of the Pactor-I mode.

Usage:

- ARQ and data communication over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK,DQPSK,8-DPSK,16-DPSK
Number of channels	2
Channel spacing (Hz)	200
Bandwidth (Hz)	450
Symbol rate (Bd)	200
Coding	Convolutional FEC code

Table 249: PACTOR II Characteristics

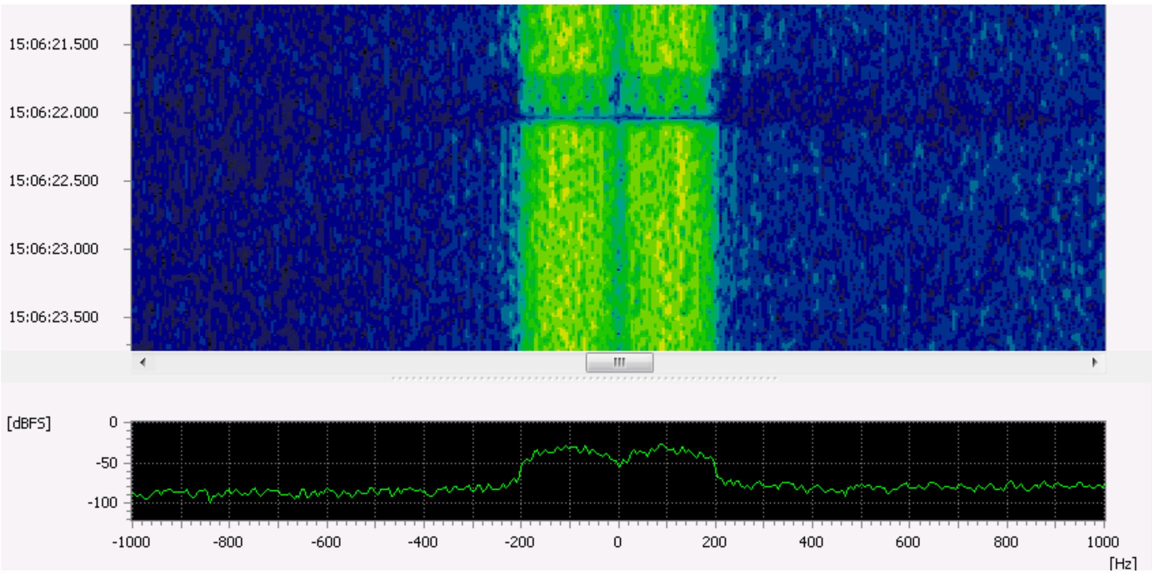


Figure 254: PACTOR II Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Pactor II
Min. burst length (s)	0.300
Max. burst length (s)	3.400
Min. pause length (s)	0.035
Min. burst SNR (dB)	0
VER file name	*pactor_ii.ver*

Table 250: PACTOR II Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 251: PACTOR II Features

PACTOR II FEC

General Information

Pactor-II-FEC mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany. It is an advancement of the Pactor-I-FEC mode.

Usage:

- Broadcast data transmissions (plain-text and encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	DQPSK
Number of channels	2
Channel spacing (Hz)	200
Bandwidth (Hz)	450
Symbol rate (Bd)	200
Coding	Convolutional FEC code, Viterbi code

Table 252: PACTOR II FEC Characteristics

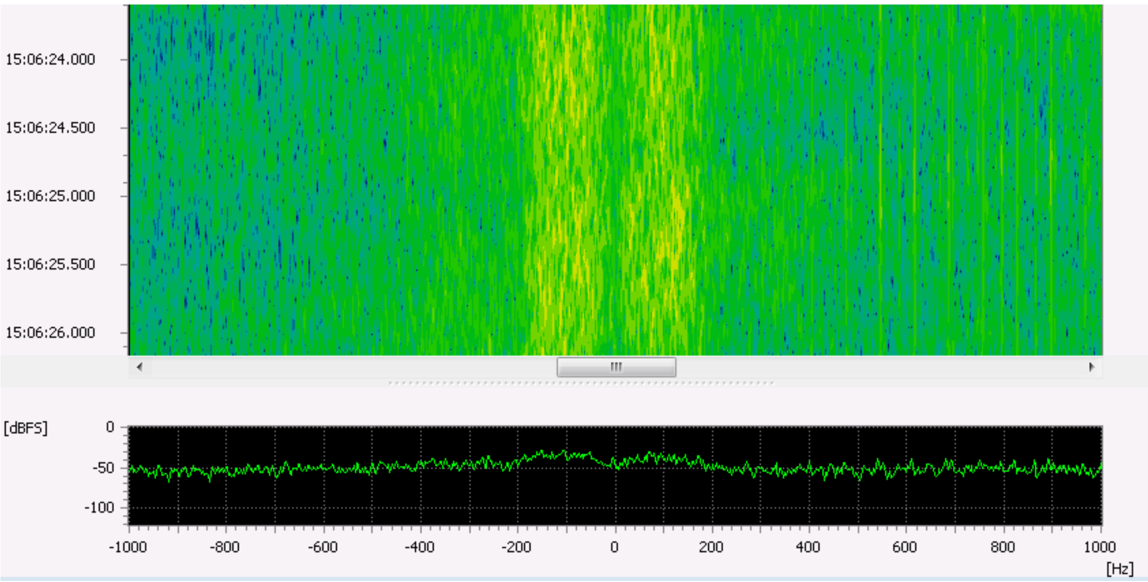


Figure 255: PACTOR II FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Pactor II
VER file name	*pactor_ii_fec.ver*

Table 253: PACTOR II FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes

Feature	Status
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 254: PACTOR II FEC Features

PACTOR III

General Information

Pactor-III mode is a proprietary standard developed by SCS GmbH & Co. KG, Hanau, Germany. It is an advancement of the Pactor-I and Pactor-II modes.

Usage:

- ARQ and broadcast data communication over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK,DQPSK
Number of channels	2,6,14,16,18
Channel spacing (Hz)	120
Bandwidth (Hz)	max 2200
Symbol rate (Bd)	100 per channel
Coding	Convolutional FEC code

Table 255: PACTOR III Characteristics

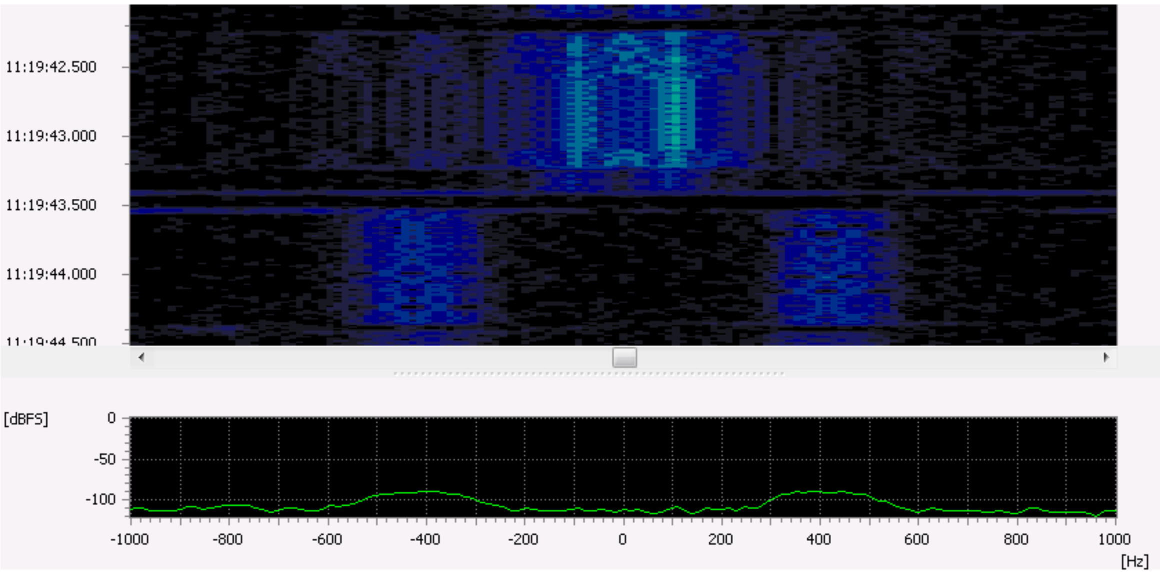


Figure 256: PACTOR III Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Pactor III
Min. burst length (s)	0.300
Max. burst length (s)	3.400

Parameter	Default
Min. pause length (s)	0.035
Min. burst SNR (dB)	0
VER file name	*pactor_iii.ver*

Table 256: PACTOR III Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 257: PACTOR III Features

Piccolo MK6

General Information

The Piccolo modes were developed in the UK for communications between Great Britain and its embassies and military stations all over the world.
They are similar to the French Coquelet modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	6
Shift (Hz)	20
Bandwidth (Hz)	180
Symbol rate (Bd)	20
Alphabet	ITA-2

Table 258: Piccolo MK6 Characteristics

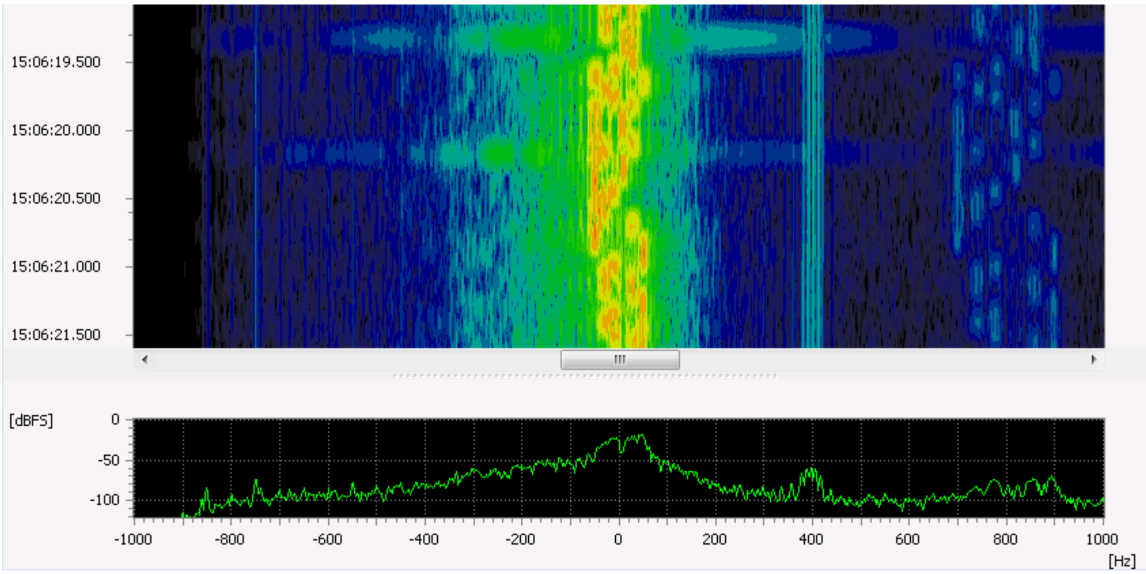


Figure 257: Piccolo MK6 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	50
TD tolerance (ms)	0.1
No. of tones	6
Tone position type	Equidistant frequencies
Tone distance (Hz)	20
VER file name	*piccolo_mk6.ver*

Table 259: Piccolo MK6 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 260: Piccolo MK6 Features

Piccolo MK12

General Information

The Piccolo modes were developed in the UK for communications between Great Britain and its embassies and military stations all over the world.
They are similar to the French Coquelet modes.

Usage:

- Transfer of textual information (mostly encrypted) over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	12
Shift (Hz)	20
Bandwidth (Hz)	300
Symbol rate (Bd)	20
Alphabet	ITA-5

Table 261: Piccolo MK12 Characteristics

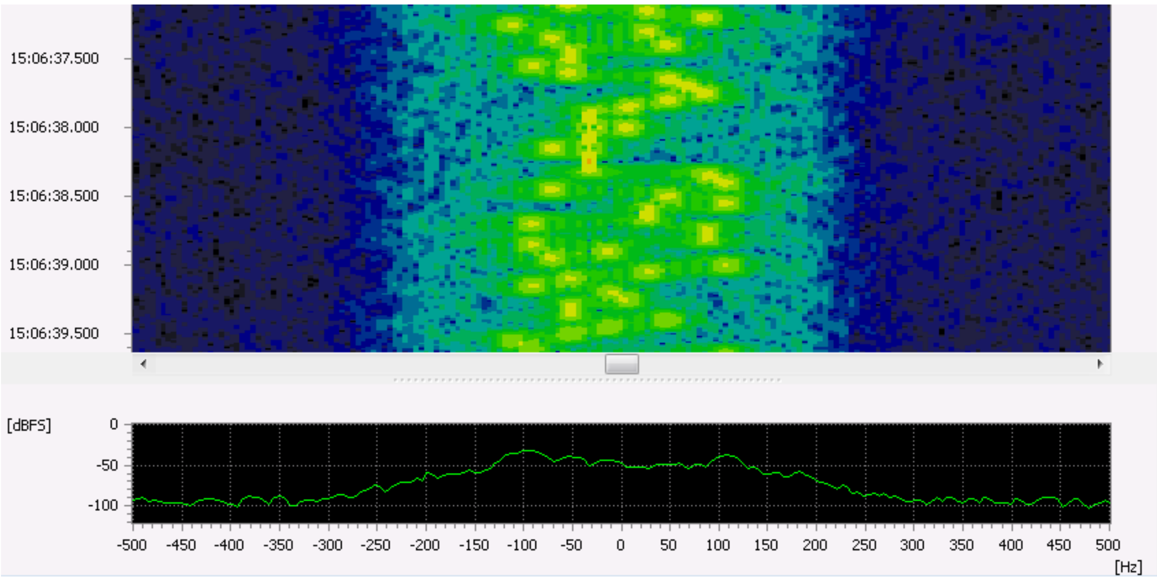


Figure 258: Piccolo MK12 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	50
TD tolerance (ms)	2
No. of tones	12
Tone position type	Equidistant frequencies
Tone distance (Hz)	20
VER file name	*piccolo_mk12.ver*

Table 262: Piccolo MK12 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 263: Piccolo MK12 Features

POL-ARQ

General Information

POL-ARQ is a synchronous duplex FARQ system. This system was used by the Ministry of Foreign Affairs of Poland.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	270
Symbol rate (Bd)	100
Alphabet	CCIR-476

Table 264: POL-ARQ Characteristics

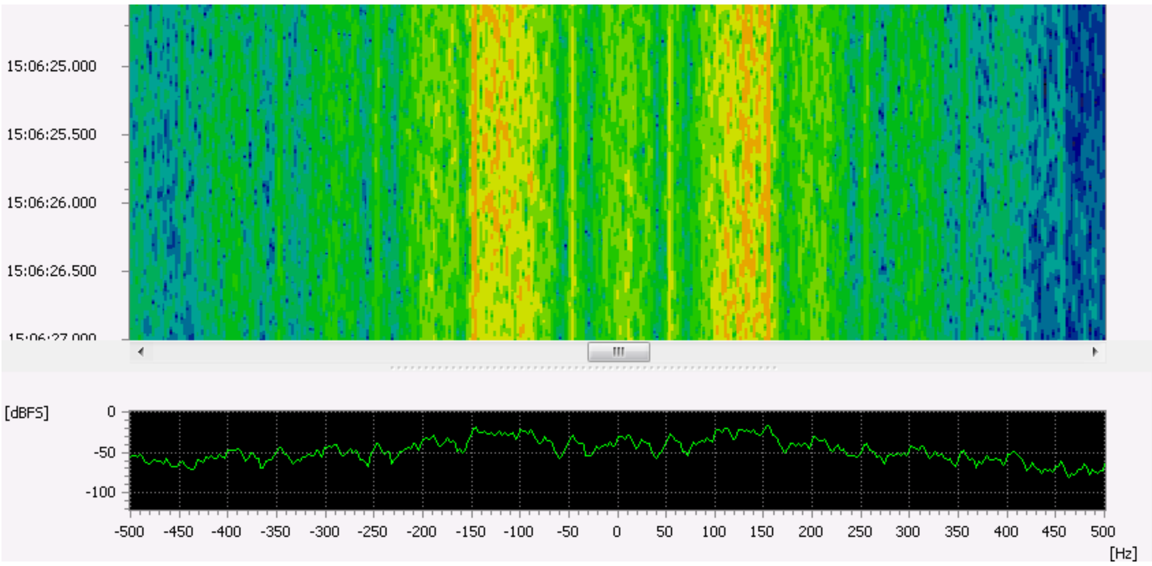


Figure 259: POL-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	270
Shift tolerance (Hz)	30
Modem type	Synchronous
VER file name	*pol-arq_100bd.ver*

Table 265: POL-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 266: POL-ARQ Features

PSK10

General Information

PSK10 is a modem type developed by radio amateurs. PSK10 emissions are very narrow-band and robust against fading effects.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK
Symbol rate (Bd)	10
Coding	Huffman coding

Table 267: PSK10 Characteristics

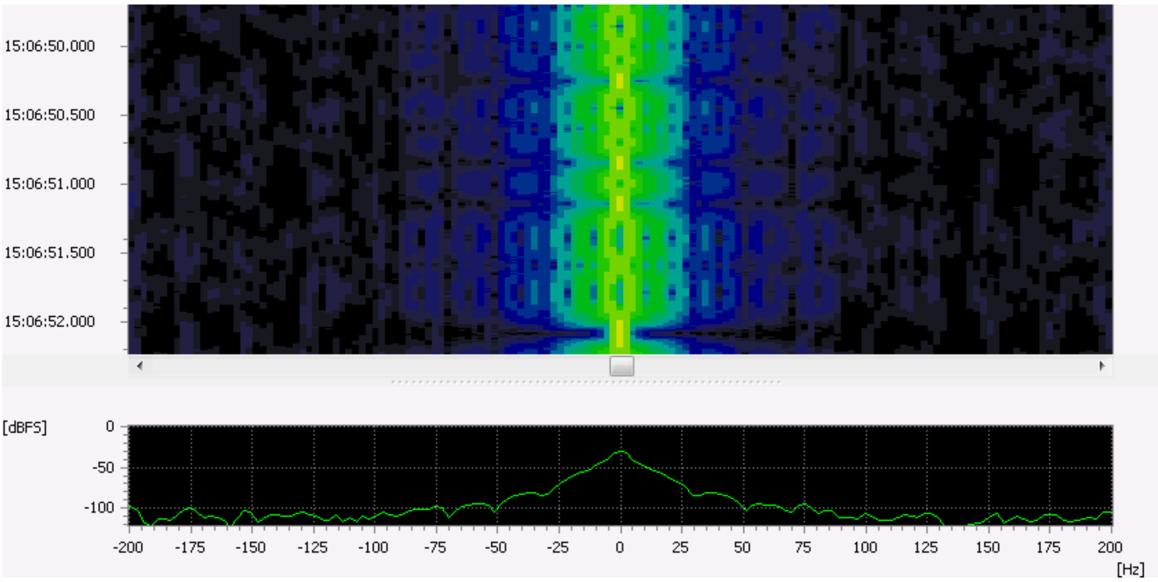


Figure 260: PSK10 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	10
SR tolerance (Bd)	0.5
Modulation order	2
Version	A
VER file name	*psk10.ver*

Table 268: PSK10 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes

Feature	Status
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 269: PSK10 Features

PSK10-AM

General Information

PSK10-AM is a modem type developed by radio amateurs. PSK10-AM emissions are very narrow-band and robust against fading effects.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK
Symbol rate (Bd)	10 / 31.25 / 50
Coding	Repetition code

Table 270: PSK10-AM Characteristics

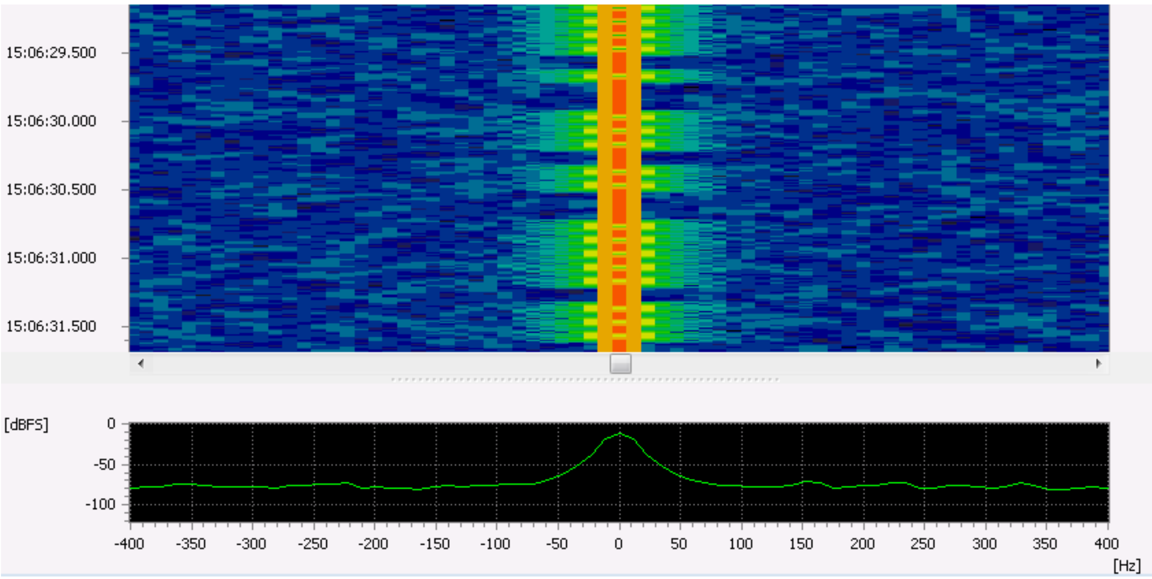


Figure 261: PSK10-AM Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	10
SR tolerance (Bd)	5
Modulation order	2

Parameter	Default
Version	A
VER file name	*psk-am_10bd.ver*

Table 271: PSK10-AM Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 272: PSK10-AM Features

PSK31

General Information

PSK31 is a modem type developed by radio amateurs. PSK31 emissions are very narrow-band and robust against fading effects.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	DBPSK,QPSK
Bandwidth (Hz)	50
Symbol rate (Bd)	31.25 (62.5 / 125)
Coding (FEC variants)	Convolutional FEC

Table 273: PSK31 Characteristics

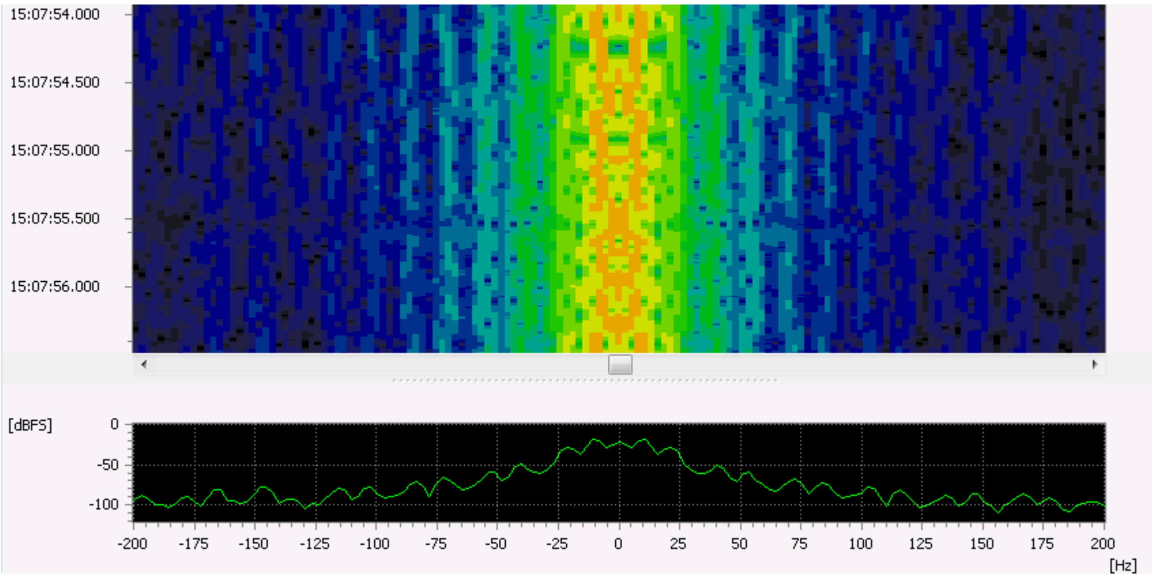


Figure 262: PSK31 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8,16 A/B
Symbol rate (Bd)	31
SR tolerance (Bd)	5
Modulation order	2
Version	A
VER file name	*psk31.ver*

Table 274: PSK31 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 275: PSK31 Features

RUM-FEC

General Information

RUM-FEC is a duplex FEC system used by the Ministry of Foreign Affairs of Romania.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Symbol rate (Bd)	164.5
Coding	Interleaving, FEC
Alphabet	RUM-FEC

Table 276: RUM-FEC Characteristics

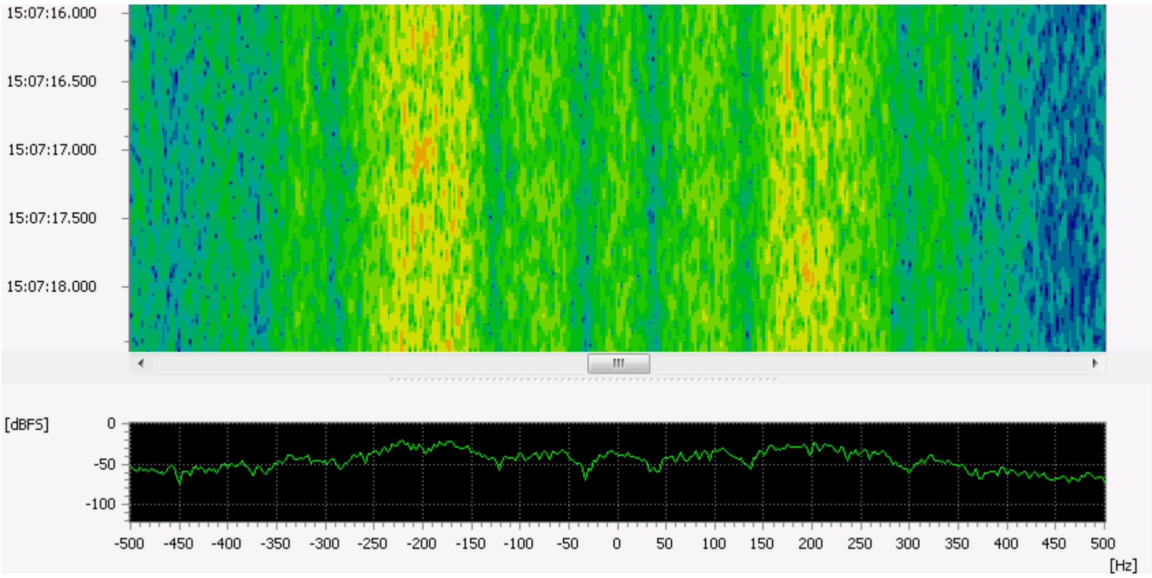


Figure 263: RUM-FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	165
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*rum-fec_165bd.ver*

Table 277: RUM-FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 278: RUM-FEC Features

SI-ARQ

General Information

SI-ARQ is an ARQ mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	400 / 500
Symbol rate (Bd)	96 / 192
Error correction	ARQ
Alphabet	ITA-2

Table 279: SI-ARQ Characteristics

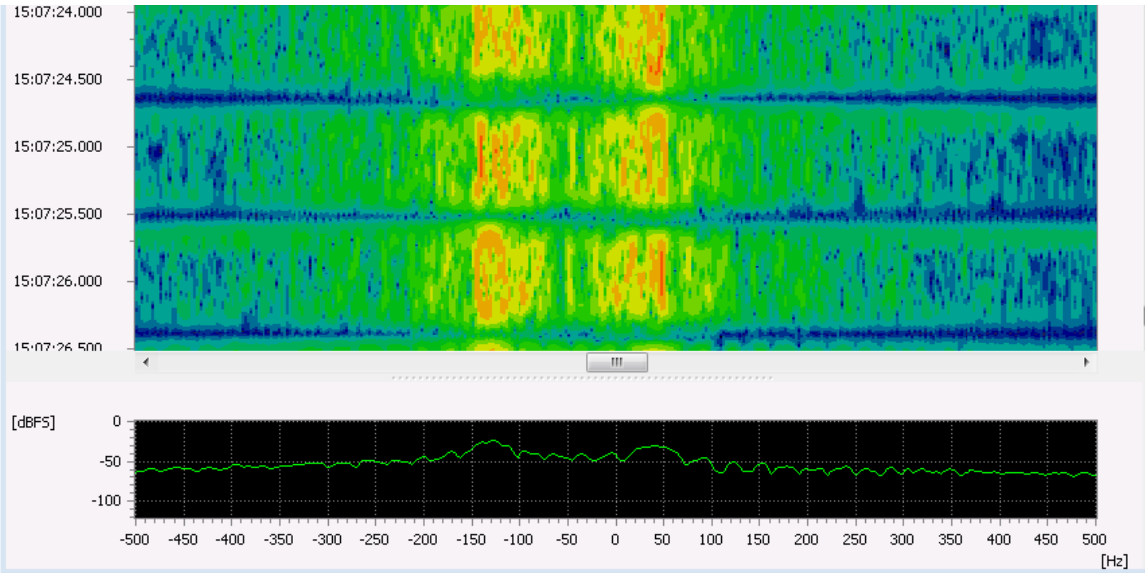


Figure 264: SI-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	1
Shift (Hz)	170
Shift tolerance (Hz)	5
Modem type	Synchronous
Min. burst length (s)	0.217
Max. burst length (s)	0.600
Min. pause length (s)	0.061
VER file name	*si-arq.ver*

Table 280: SI-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 281: SI-ARQ Features

SI-FEC

General Information

SI-FEC is an FEC mode similar to SITOR for the exchange of teletype-data over a radio channel in a robust way.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	400 / 500
Symbol rate (Bd)	96 / 192
Error correction	FEC
Alphabet	ITA-2

Table 282: SI-FEC Characteristics

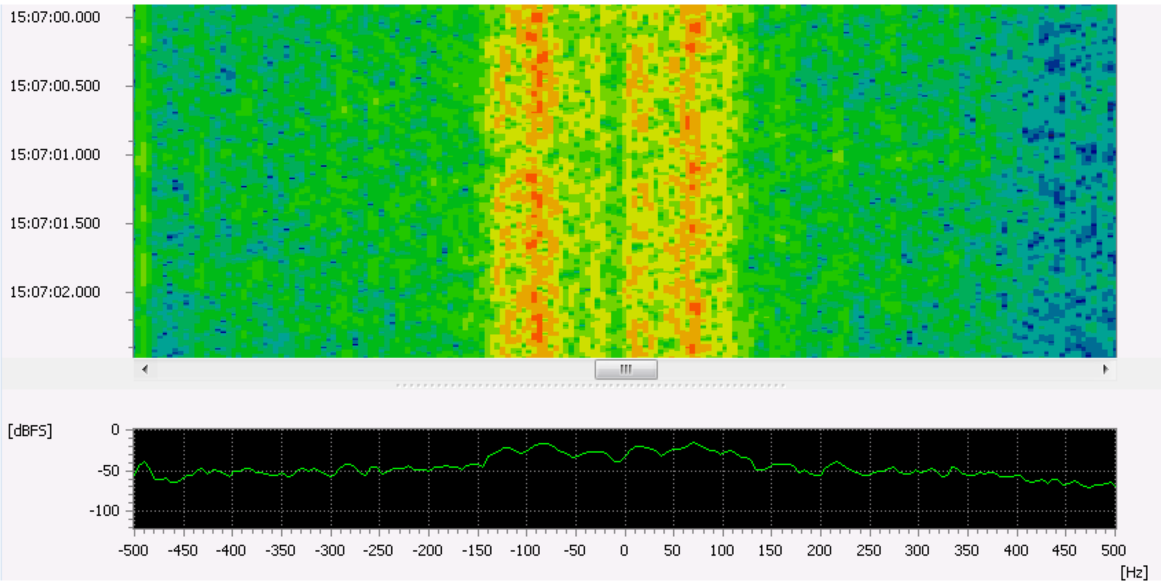


Figure 265: SI-FEC Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	96
SR tolerance (Bd)	5
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*si-fec.ver*

Table 283: SI-FEC Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 284: SI-FEC Features

SITOR-A

General Information

SImplex Teletype Over Radio (SITOR) is a mode for maritime communications to exchange teletype-data over a radio channel in a robust way.
SITOR-A is the ARQ variant.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170
Bandwidth (Hz)	350
Symbol rate (Bd)	100
Error correction	ARQ
Alphabet	ITA-2

Table 285: SITOR-A Characteristics

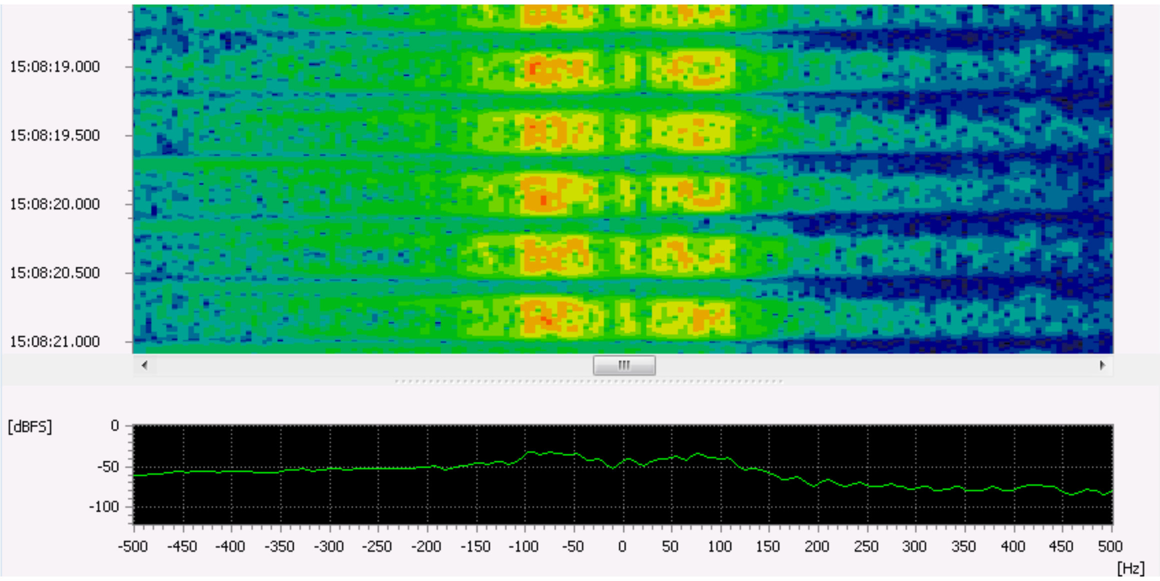


Figure 266: SITOR-A Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	170
Shift tolerance (Hz)	10
Modem type	Synchronous

Parameter	Default
Min. burst length (s)	0.065
Max. burst length (s)	0.290
Min. pause length (s)	0.200
VER file name	*sitor-a_170hz.ver*

Table 286: SITOR-A Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 287: SITOR-A Features

SITOR-B

General Information

SImplex Teletype Over Radio (SITOR) is a mode for maritime communications to exchange teletype-data over a radio channel in a robust way.
SITOR-B is the FEC variant.

Usage:

- Basic maritime data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	170 / 400
Bandwidth (Hz)	350 / 800
Symbol rate (Bd)	100
Error correction	FEC
Alphabet	ITA-2

Table 288: SITOR-B Characteristics

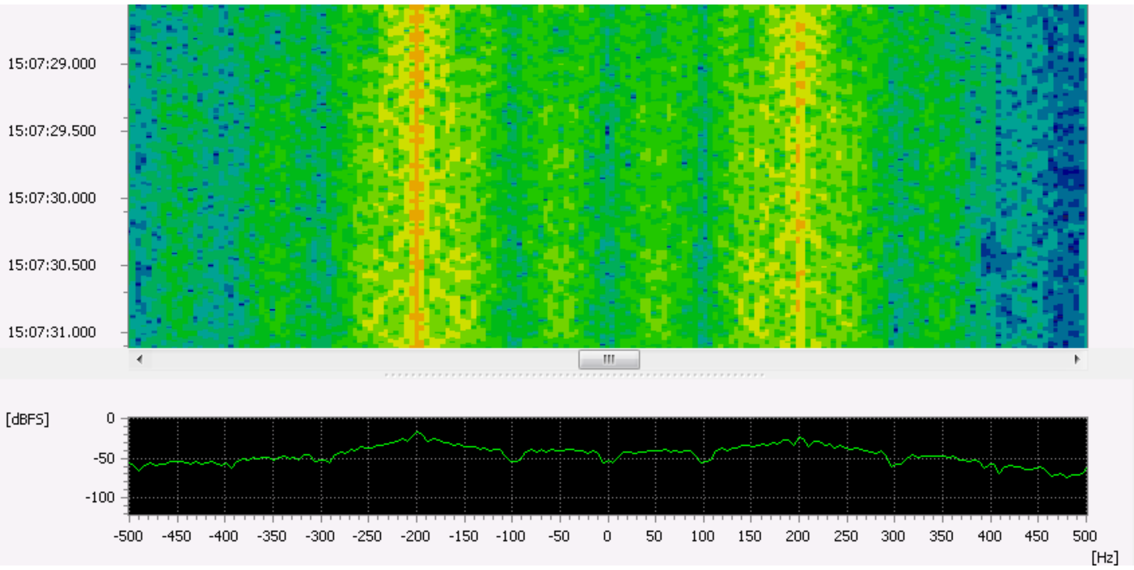


Figure 267: SITOR-B Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	20
Modem type	Synchronous
VER file name	*sitor-b_100bd_400hz.ver*

Table 289: SITOR-B Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 290: SITOR-B Features

SP14

General Information

This standard is a system with 14 tones where only 13 tones are used. The carrier is AM modulated with a secondary MFSK modulation for the data.
SP-14 is equivalent to NUM-13.

Usage:

- Transmission of numeric codes.

Mode Properties

Parameter	Value
Modulation, primary secondary	AM MFSK
Number of tones	14
Tone length (ms)	133
Tone spacing (Hz)	16
Bandwidth (Hz)	210
Symbol rate (Bd)	7.5
Coding	Character coding

Table 291: SP14 Characteristics

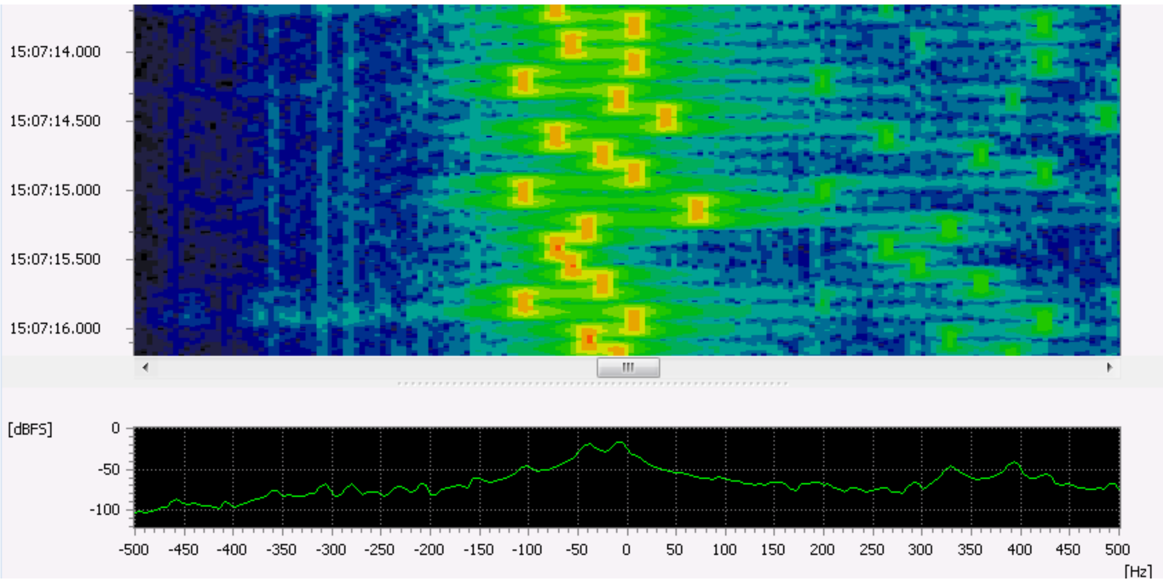


Figure 268: SP14 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Multitone (MFSK)
Tone duration (ms)	133
TD tolerance (ms)	5
No. of tones	14
Tone position type	Equidistant frequencies

Parameter	Default
Tone distance (Hz)	16
VER file name	*sp14.ver*

Table 292: SP14 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 293: SP14 Features

SPREAD 51

General Information

SPREAD 51 is a synchronous FEC system which was used by the Ministry of Foreign Affairs in Romania.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Symbol rate (Bd)	102.7
Coding	10 Bit Bauer code, Interleaving
Alphabet	ITA-2

Table 294: SPREAD 51 Characteristics

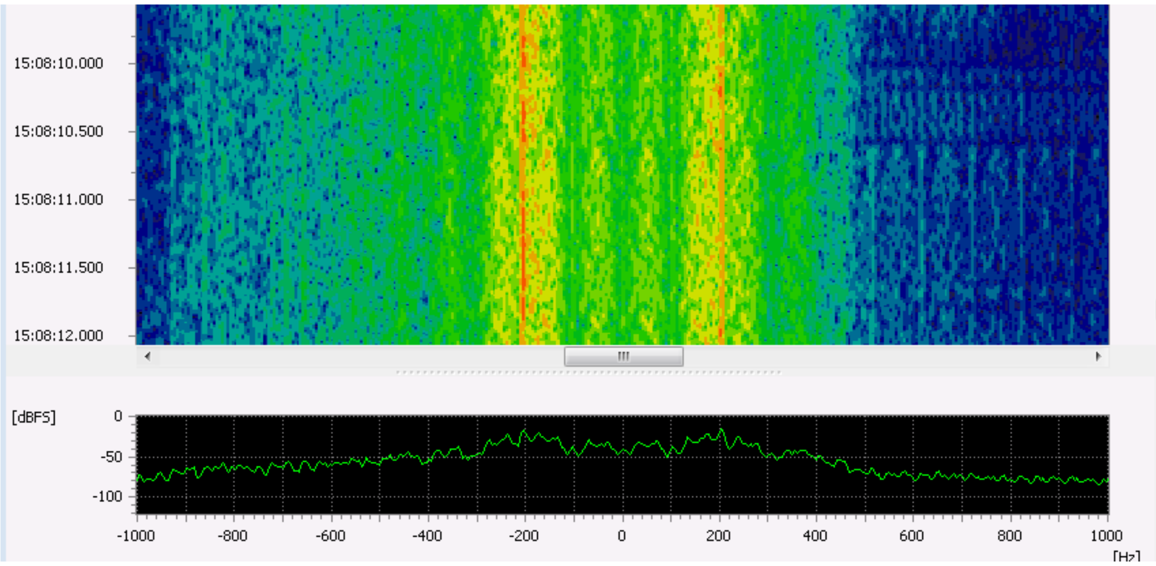


Figure 269: SPREAD 51 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	102.7
SR tolerance (Bd)	1
Shift (Hz)	400
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*spread51.ver*

Table 295: SPREAD 51 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 296: SPREAD 51 Features

SWED-ARQ

General Information

SWED-ARQ is an adaptive fsk system which was used for diplomatic communication with Swedish embassies. This system is no longer in operation.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	400
Symbol rate (Bd)	100
Alphabet	CCIR-476

Table 297: SWED-ARQ Characteristics

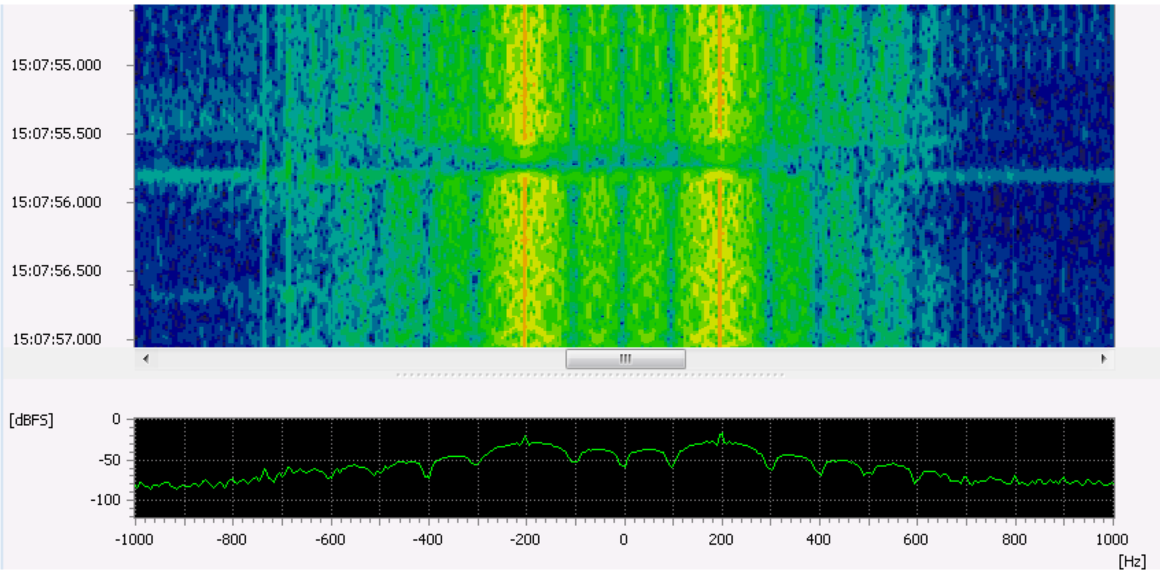


Figure 270: SWED-ARQ Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Shift (Hz)	400
Shift tolerance (Hz)	10
Modem type	Synchronous
Min. burst length (s)	0.065
Max. burst length (s)	1.700
Min. pause length (s)	0.200
VER file name	*swed_arqver*

Table 298: SWED-ARQ Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 299: SWED-ARQ Features

TWINPLEX

General Information

TWINPLEX is a 2 channel frequency domain multiplex ARQ system for data communications.

Usage:

- Transfer of textual information over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	4
Symbol rate (Bd)	50
Error correction	ARQ
Alphabet	ITA-3

Table 300: TWINPLEX Characteristics

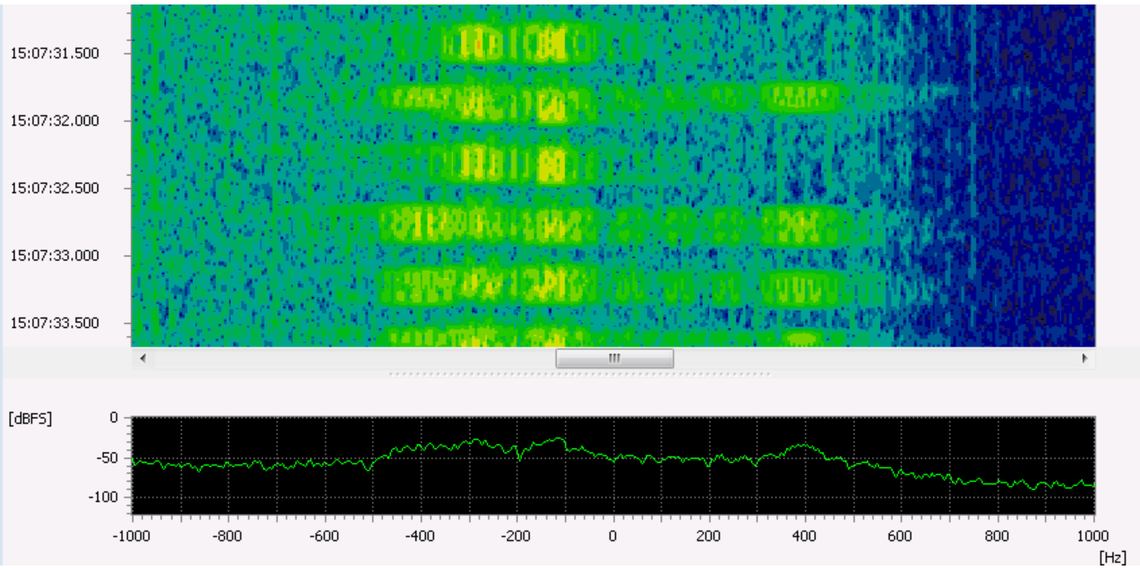


Figure 271: TWINPLEX Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	F6/F7B
F7B mode	Data (interleaved)
Symbol rate (Bd)	100
SR tolerance (Bd)	5
Distance F1 <-> F2 (Hz)	115
Distance F2 <-> F3 (Hz)	170
Distance F3 <-> F4 (Hz)	515
Shift tolerance (Hz)	20
Min. burst length (s)	0.180
Max. burst length (s)	0.250
Min. pause length (s)	0.100
VER file name	twinplex.ver

Table 301: TWINPLEX Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 302: TWINPLEX Features

Visel

General Information

Visel is a synchronous teleprinter system used in former Yugoslavia.
It is unknown whether the system is still in use.

Usage:

- Data communication over HF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	300
Symbol rate (Bd)	81.3 / 123.5 / 125
Error correction	FEC
Alphabet	ITA-2

Table 303: Visel Characteristics

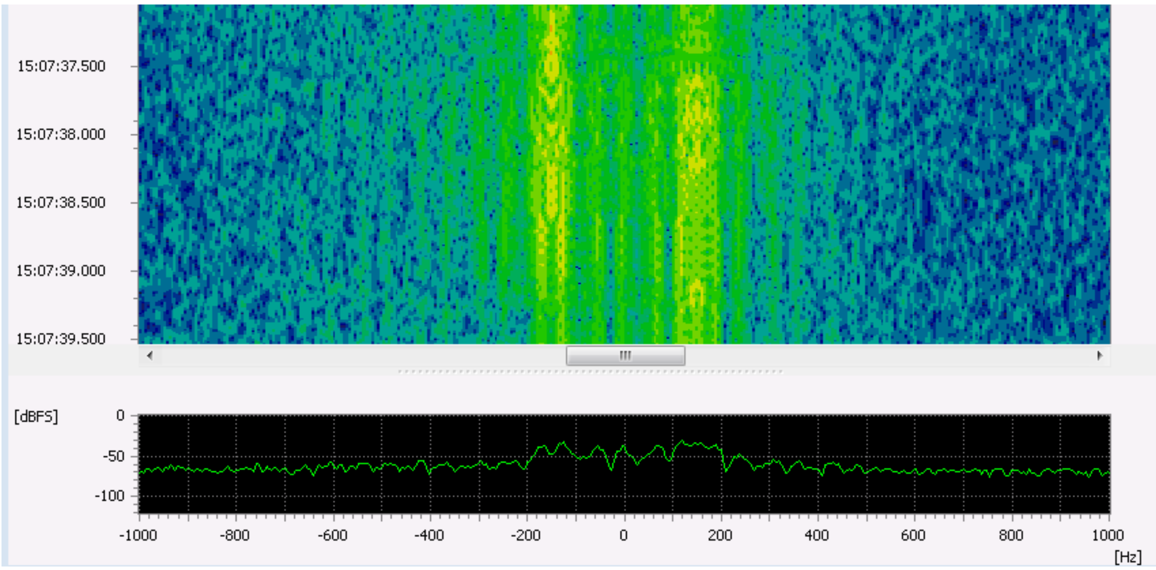


Figure 272: Visel Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	120.9
SR tolerance (Bd)	3
Shift (Hz)	300
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*visel.ver*

Table 304: Visel Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 305: Visel Features

Standard Decoders VHF/UHF

Version History

Release	Date	Editor	History
1.0	2013-07-05	MBu	Start

Available Decoders

ACARS VHF

General Information

Aircraft **C**ommunication **A**ddressing and **R**eporting **S**ystem (ACARS) is a digital datalink system for exchange of small messages between aircraft and ground stations.

Usage:

- Aeronautical communication on VHF.

Mode Properties

Parameter	Value
Modulation, primary secondary	DSB-AM MSK
Shift (Hz)	1200
Bandwidth (kHz)	25
Symbol rate (Bd)	2400
Coding	CRC

Table 306: ACARS VHF Characteristics

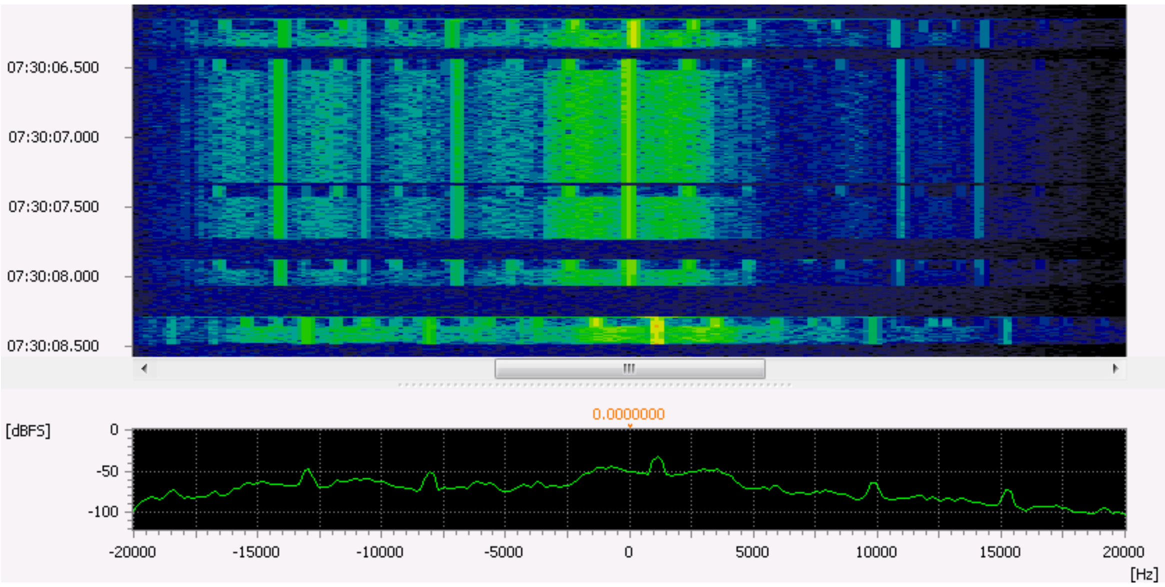


Figure 273: ACARS VHF Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	G (MSK)
Type	MSK
Symbol rate (Bd)	2400
SR tolerance (Bd)	2.000
BT	1.0
Min. burst length (s)	0.050
Max. burst length (s)	2.000
Min. pause length (s)	0.010
VER file name	*acars_vhf.ver*

Table 307: ACARS VHF Demodulator Settings

Tuning

- The tuning frequency is the peak 20 kHz above the low cutoff-frequency of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 308: ACARS VHF Features

AIS

General Information

The universal ship borne **A**utomatic **I**dentification **S**ystem (AIS) was created for efficient exchange of navigational data among ships and between ships and stations ashore to improve safety of navigation.

Usage:

- Worldwide radio system for ship collision avoidance and navigational advice.

Mode Properties

Parameter	Value
Modulation, primary secondary	FM GMSK
BT product 12.5 kHz 25 kHz	0.3 or 0.5 max 0.5
Symbol rate (Bd)	9600
Coding	NRZI and CRC

Table 309: AIS Characteristics

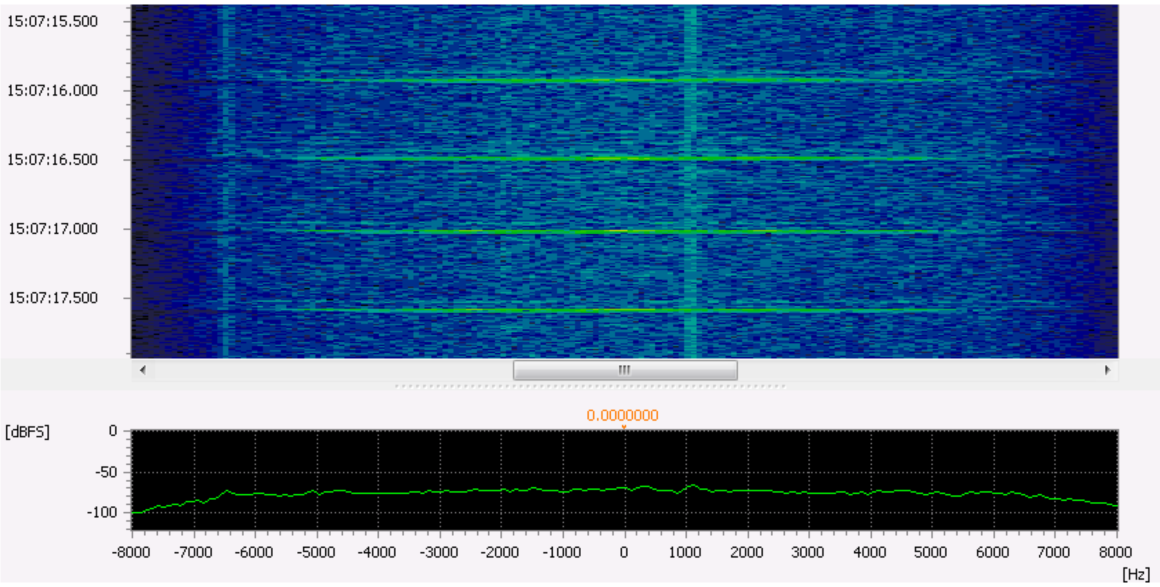


Figure 274: AIS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	G (MSK)
Type	GMSK
Symbol rate (Bd)	9600
SR tolerance (Bd)	20.000
BT	0.40
Min. burst length (s)	0.040
Max. burst length (s)	0.080

Parameter	Default
Min. pause length (s)	0.440
VER file name	*ais.ver*

Table 310: AIS Demodulator Settings

Tuning

- The tuning frequency is 11.340 kHz above the pilot-tone.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 311: AIS Features

CCIR

General Information

These SelCal standards are based on the CCIR-Recommendations (now ITU) CCIR-1, CCIR-2(CCIR-7) and PCCIR. CCIR-1 and CCIR-2 vary in the nominal tone duration.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 312: CCIR Characteristics

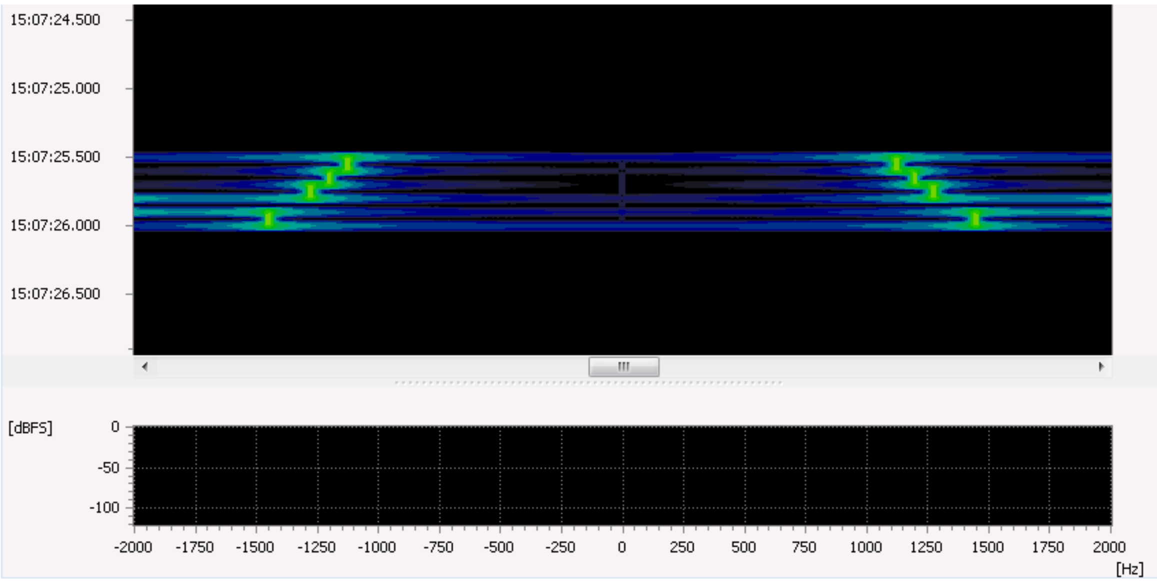


Figure 275: CCIR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	10
No. of tones	17
SELCAL type	CCIR-1/PCCIR
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	3
VER file name	*ccir.ver*

Table 313: CCIR Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 314: CCIR Features

CCITT

General Information

This SelCal standards is based on an CCITT-Recommendation (now ITU) for tone-based selective calling.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	15
Coding	Character coding

Table 315: CCITT Characteristics

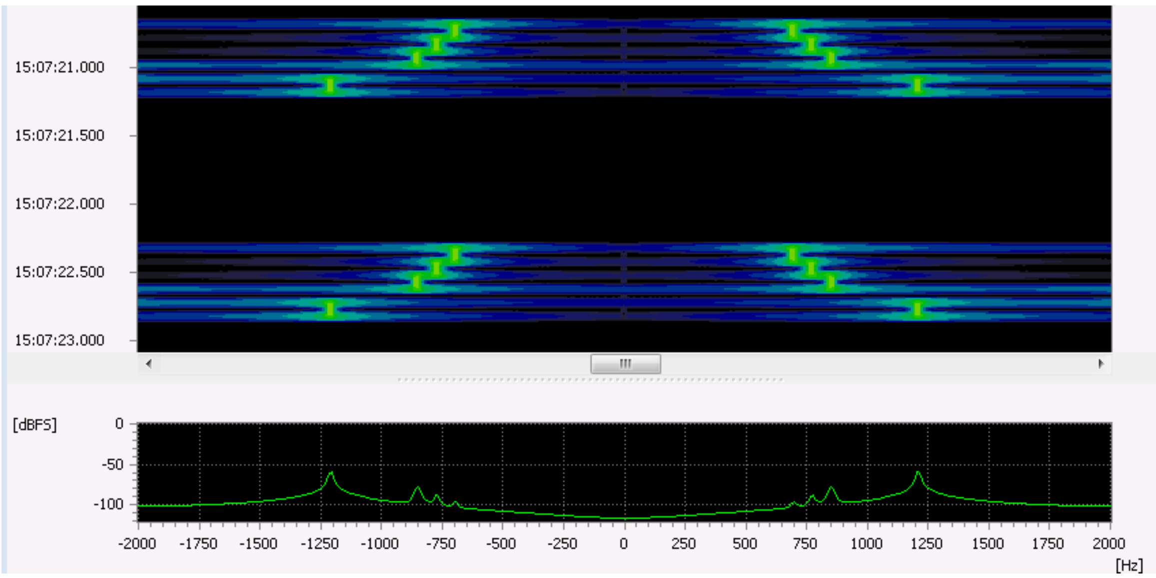


Figure 276: CCITT Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	5
No. of tones	11
SELCAL type	Euro
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	3
VER file name	*ccitt.ver*

Table 316: CCITT Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 317: CCITT Features

CTCSS

General Information

The **C**ontinuous **T**one **C**oded **S**quelch **S**ystem (CTCSS) was developed for use with analog voice radios. Analog radios equipped with the CTCSS system transmit a tone simultaneously with the voice signal. CTCSS radios enable the selection of particular radio units by recognition of the CTCSS tones. CTCSS tones are standardized by the EIA/TIA, but some systems use non-standard tones

Usage:

- Analog voice radio with station selection.

Mode Properties

Parameter	Value
Modulation	Multi-tone
Number of tones	38

Table 318: CTCSS Characteristics

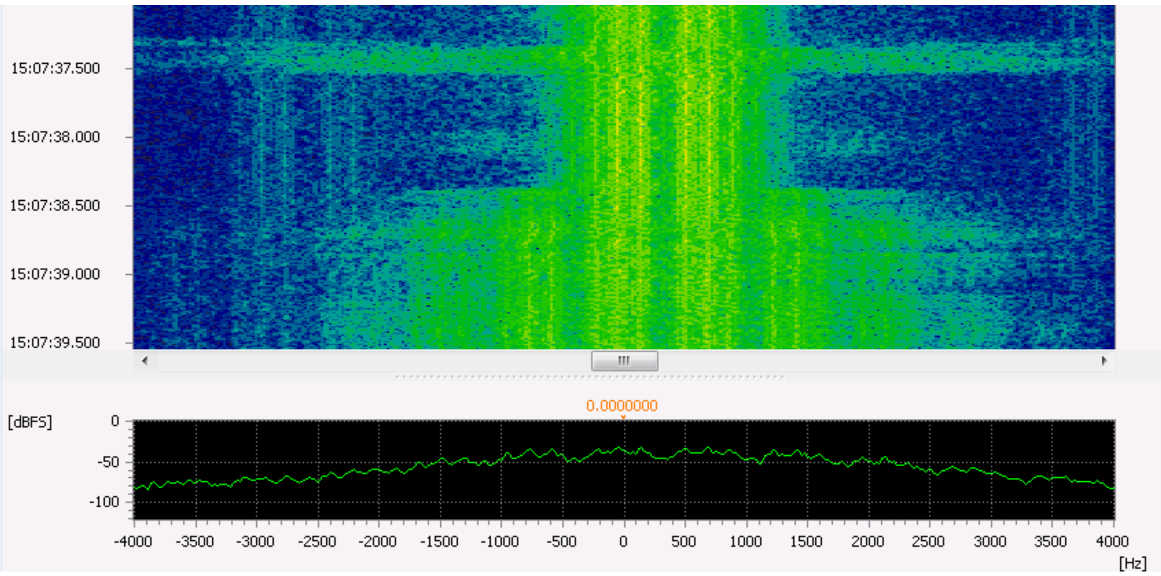


Figure 277: CTCSS Spectrogram

go2DECODE

Demodulator Settings

Parameter	Default
Demodulator	Voice
Voice mode	F3E
SELCAL type	CTCSS
Sensitivity	Middle
VER file name	*ctcss.ver*

Table 319: CTCSS Demodulator Settings

Tuning

- The tuning frequency is 240 Hz below the center peak.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 320: CTCSS Features

DMR

General Information

Digital **M**obile **R**adio (DMR) is a digital modem with 12.5 kHz channel spacing and TDMA based protocol described in the ETSI technical standards.

TS 102 398: General Design

TS 102 361:

Part 1: DMR Air Interface (AI) protocol

Part 2: DMR voice and generic services and facilities

Part 3: DMR Data protocol

Part 4: DMR trunking protocol

TS 102 362: Conformance Testing

Usage:

- Category 1: Individuals and industries with low requirements, small-scale applications.
- Category 2: Industries with high demands on business-critical large-scale communication.

Mode Properties

Parameter	Value
Duplex method	FDD or TDD
Modulation	FSK

Parameter	Value
Number of tones	4
Tone spacing (Hz)	1296
Symbol rate (Bd)	4800

Table 321: DMR Characteristics

Figure 278: DMR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	4800
SR tolerance (Bd)	10
Modulation order	4
Shift (Hz)	4080
Shift tolerance (Hz)	0
Modem type	Synchronous
Min. burst length (s)	0.015
Max. burst length (s)	0.045
Min. pause length (s)	0.015
VER file name	*dmr.ver*

Table 322: DMR Demodulator Settings

Tuning

- The tuning frequency is 240 Hz below the center peak.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding, Binary Data Voice Data	yes under development
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 323: DMR Features

Vocoder

The DVSI AMBE+2™ vocoder is based on Multi-Band Excitation (MBE), i.e. a frequency domain approach. Main characteristics are:

- very low bit rate 2450 bps (voice) + 1150 bps (FEC) = 3600 bps.
- very high voice quality at very low bit rate.
- robust to strong background noise and to PMR/LMR channel.
- moderate complexity, easy to implement on a low-cost DSP.
- language independent.

- 20ms voice frame and FEC optimized for PMR/LMR applications.
- soft bits based decoding.

dPMR

General Information

digital **P**rivate **M**obile **R**adio (dPMR) is a digital radio protocol for voice and data communications. dPMR is a narrowband (6,25 kHz channel spacing) FDMA based protocol described in the ETSI technical standards TS102 490 and TS102 658.

Usage:

- Professional and private voice & data communications.

Mode Properties

Parameter	Value
Modulation	Multi tone
Number of tones	4
Tone spacing (Hz)	700
Symbol rate (Bd)	2400
Coding	FEC

Table 324: dPMR Characteristics

Figure 279: dPMR Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	2400
SR tolerance (Bd)	1
Modulation order	4
Shift (Hz)	2200
Shift tolerance (Hz)	0
Modem type	Synchronous
VER file name	*dpmr.ver*

Table 325: dPMR Demodulator Settings

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding, Binary Data Voice Data	yes under development
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 326: dPMR Features

DSC

General Information

DSC (**D**igital **S**elective **C**alling) is part of the GMDSS (Global Maritime Distress and Safety System). It provides automatically formatted distress alerts, urgency, safety and routine radio-telephone calls.

Usage:

- Data communication over HF / VHF.

Mode Properties

Parameter	Value
Modulation, primary secondary	FM FSK
Number of tones	2
Shift (Hz)	800
Bandwidth (KHz)	10
Symbol rate (Baud)	1200
Coding	Checksum

Table 327: DSC VHF Characteristics

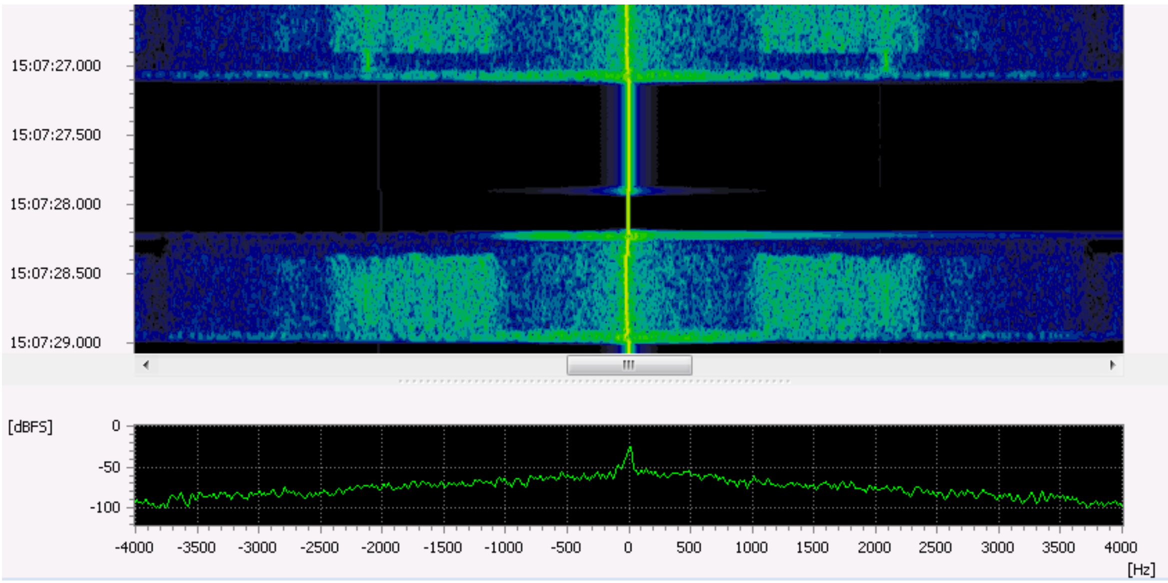


Figure 280: DSC VHF Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	1200
SR tolerance (Bd)	5
Modulation order	2
Shift (Hz)	800

Parameter	Default
Shift tolerance (Hz)	20
Modem type	Synchronous
Min. burst length (s)	0.300
Max. burst length (s)	0.600
Min. pause length (s)	0.100
VER file name	*dsc-vhf.ver*

Table 328: DSC VHF Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment VHF	yes
Combination with other modems (modem list)	yes

Table 329: DSC Features

EEA

General Information

The EEA SelCal standard was defined by the **E**lectronic **E**ngineering **A**ssociation, UK.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 330: EEA Characteristics

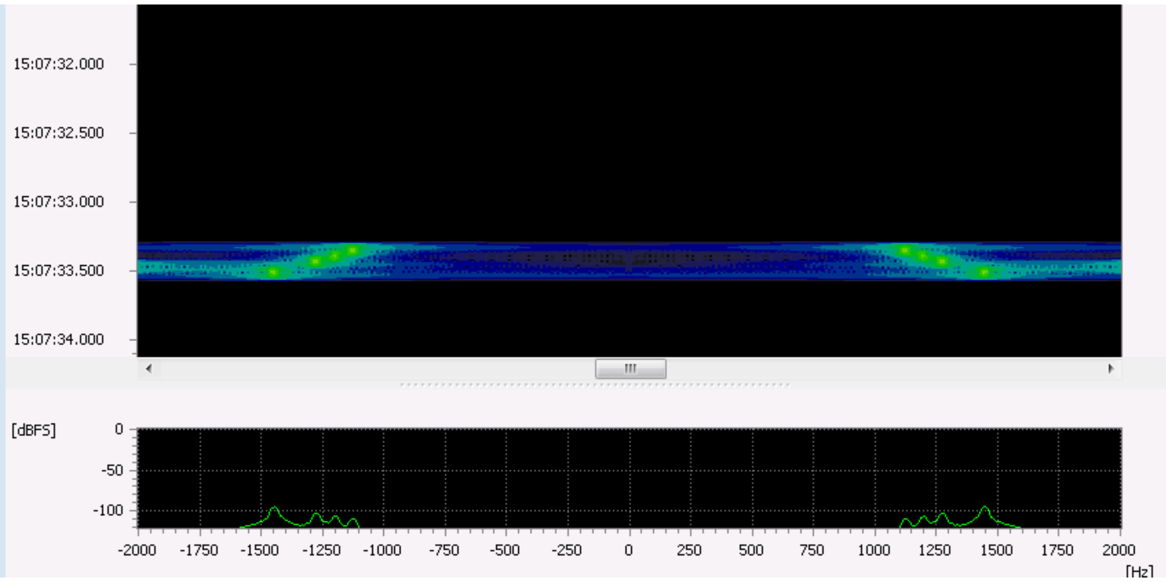


Figure 281: EEA Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	40
TD tolerance (ms)	4
No. of tones	16
SELCAL type	EEA
Min. burst length (s)	0.160
Max. burst length (s)	1.000
Min. pause length (s)	0.040
Min. burst SNR (dB)	0
VER file name	*eea.ver*

Table 331: EEA Demodulator Settings

Tuning

- The tuning frequency is the center of the signal’s frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 332: EEA Features

EIA

General Information

The EEA SelCal standard was defined by the **E**lectronics **I**ndustries **A**ssociation, USA.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	15
Coding	Character coding

Table 333: EIA Characteristics

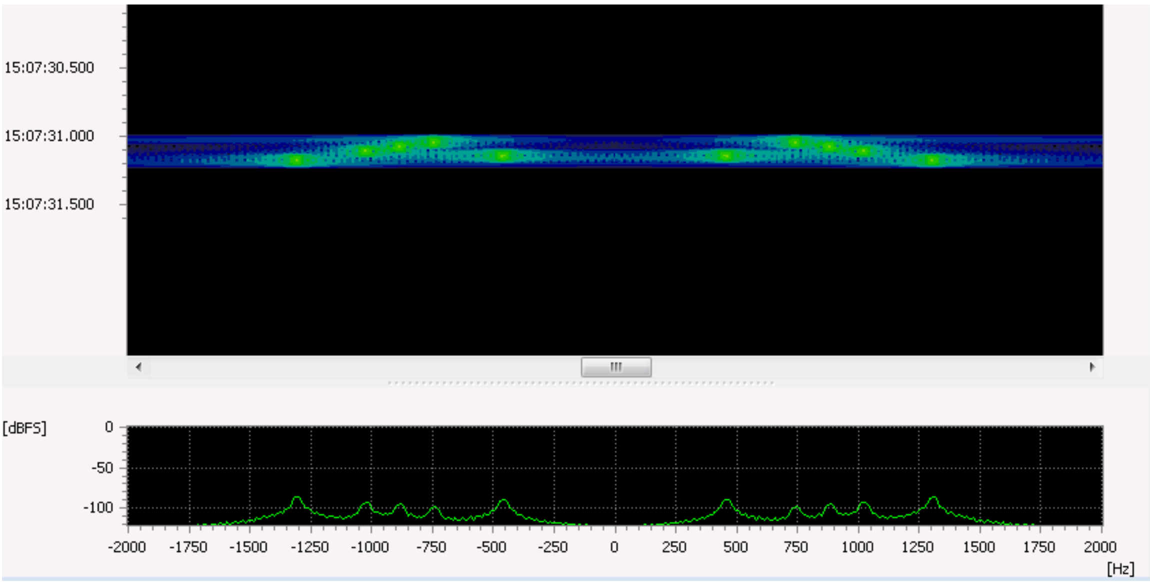


Figure 282: EIA Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	33
TD tolerance (ms)	4
No. of tones	15
SELCAL type	EIA
Min. burst length (s)	0.132
Max. burst length (s)	1.000
Min. pause length (s)	0.033
Min. burst SNR (dB)	0
VER file name	*eia.ver*

Table 334: EIA Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 335: EIA Features

Euro

General Information

Euro is an SelCal supplement to the analog voice transmission capability which enables an operator to address his call to single subscribers or groups.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 336: Euro Characteristics

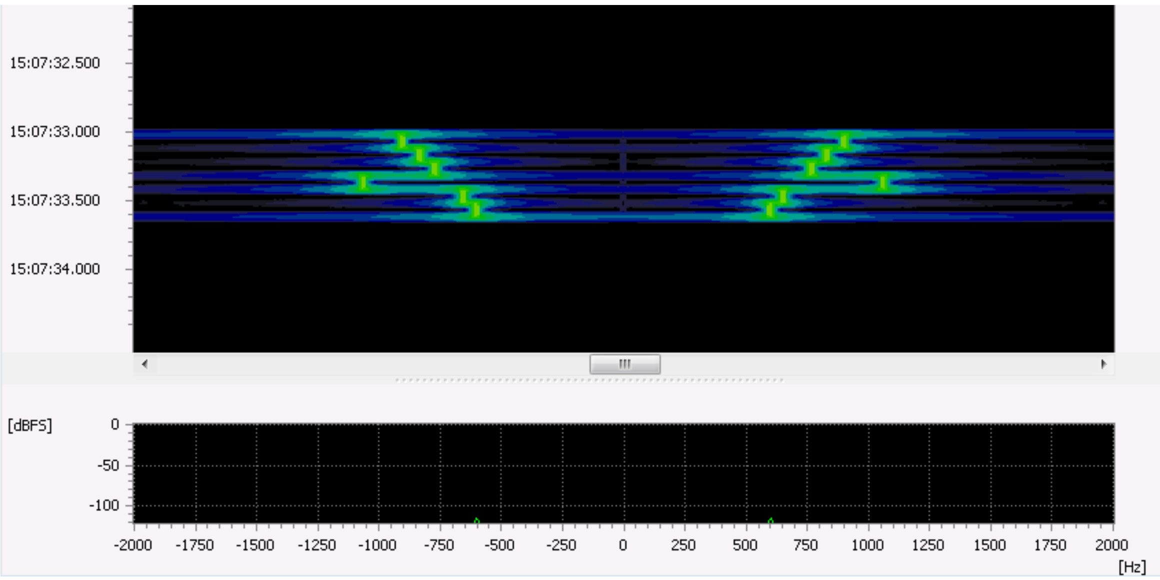


Figure 283: Euro Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	5
No. of tones	11
SELCAL type	Euro
Min. burst length (s)	0.400
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	3
VER file name	*euro.ver*

Table 337: Euro Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 338: Euro Features

FLEX

General Information

FLEX is a high speed pager protocol developed by Motorola. Two Messaging Systems are currently defined, the FLEX one-way data messaging protocol and the ReFLEX two-way data messaging protocol.

Usage:

- Broadcast paging on VHF.

Mode Properties

Parameter	Value
Modulation	FFSK-2 FFSK-4
Symbol rate (Bd)	1600 3200
Data rate (bps)	1600 3200 6400
Coding	BCH(31,21)
Alphabet	ITA-5

Table 339: FLEX Characteristics

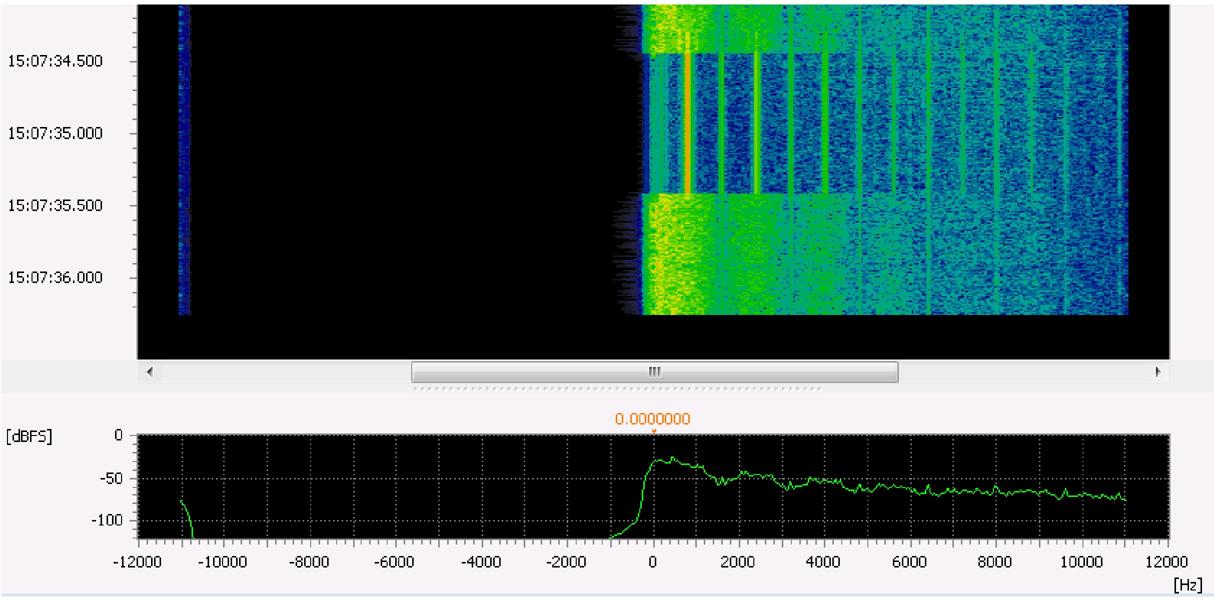


Figure 284: FLEX Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	1600
SR tolerance (Bd)	5
Shift (Hz)	9600
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*flex_1600bd_fsk2*

Table 340: FLEX Demodulator Settings

Tuning

- The tuning frequency is the lowest tone.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding, FFSK-2 FFSK-4	yes no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 341: FLEX Features

FMS-BOS

General Information

The radio reporting system, German “**F**unk**M**elde**S**ystem” (FMS), for agencies and organizations with safety assignments, German “**B**ehörden und **O**rganisationen mit **S**icherheitsaufgaben” (BOS), is a radio communication system for security authorities and organizations.

Usage:

- VHF security related communications.

Mode Properties

Parameter	Value
Modulation, primary secondary	FM FSK
Shift (Hz)	600
Bandwidth (Hz)	1800
Symbol rate (Bd)	1200
Coding	BCD and CRC

Table 342: FMS-BOS Characteristics

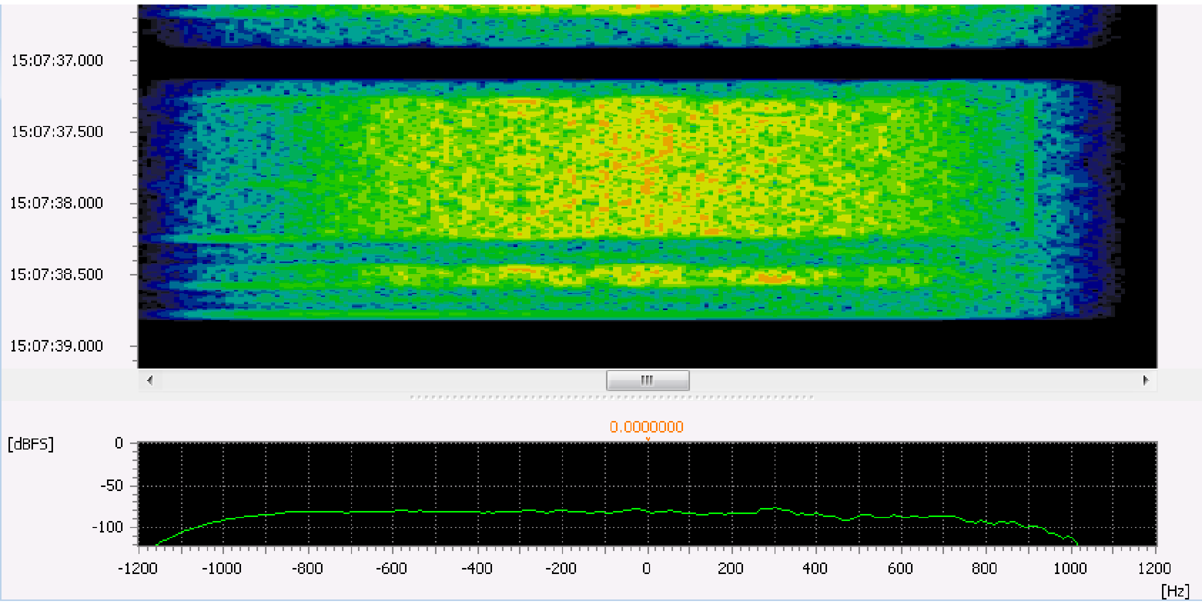


Figure 285: FMS-BOS Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2,3,4 discr.
Symbol rate (Bd)	1200
SR tolerance (Bd)	10
Modulation order	2
Shift (Hz)	600
Shift tolerance (Hz)	10
Modem type	Synchronous

Parameter	Default
Min. burst length (s)	0.120
Max. burst length (s)	1.200
Min. pause length (s)	0.150
VER file name	*fms_bos.ver*

Table 343: FMS-BOS Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 344: FMS-BOS Features

Golay Pager

General Information

Golay - Pager is a paging protocol developed by Motorola Inc. Another designation for this modem type is Golay Sequential Code (GSC).

Usage:

- Alert and status messages, emergency services etc. on VHF.

Mode Properties

Parameter	Value
Modulation	FSK
Number of tones	2
Shift (Hz)	2000
Bandwidth (Hz)	2600
Symbol rate (Bd)	300 / 600
Coding	Golay(23,12) and BCH(15,7)

Table 345: Golay Pager Characteristics

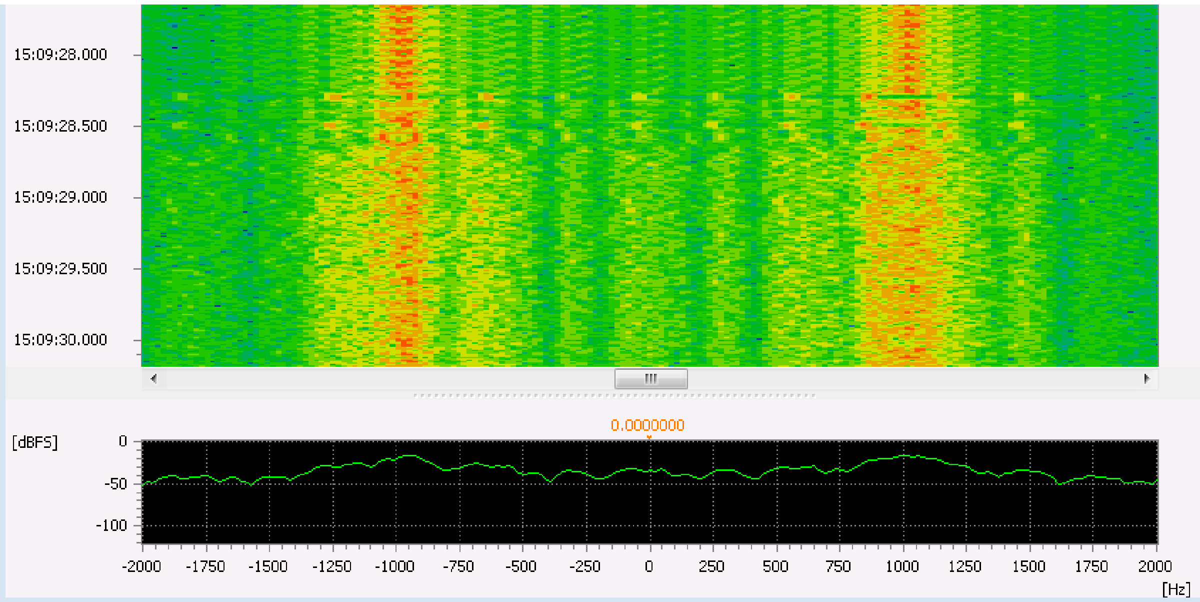


Figure 286: Golay Pager Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK 2 matched
Symbol rate (Bd)	600
SR tolerance (Bd)	5
Shift (Hz)	2000
Shift tolerance (Hz)	10
Modem type	Synchronous
VER file name	*golay_pager.ver*

Table 346: Golay Pager Demodulator Settings

Tuning

- The tuning frequency is the center of the signal.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 347: Golay Pager Features

MPT1327

General Information

MPT1327 is a Signaling Standard for Trunked Private Land Line Mobile Radio Systems, issued by the British Radiocommunication Agency.

Usage:

- Mobile voice and data communication.

Mode Properties

Parameter	Value
Modulation	FFSK
Number of channels	1 + 1024
Bandwidth (Hz)	12500
Symbol rate (Bd)	1200
Coding	CRC

Table 348: MPT1327 Characteristics

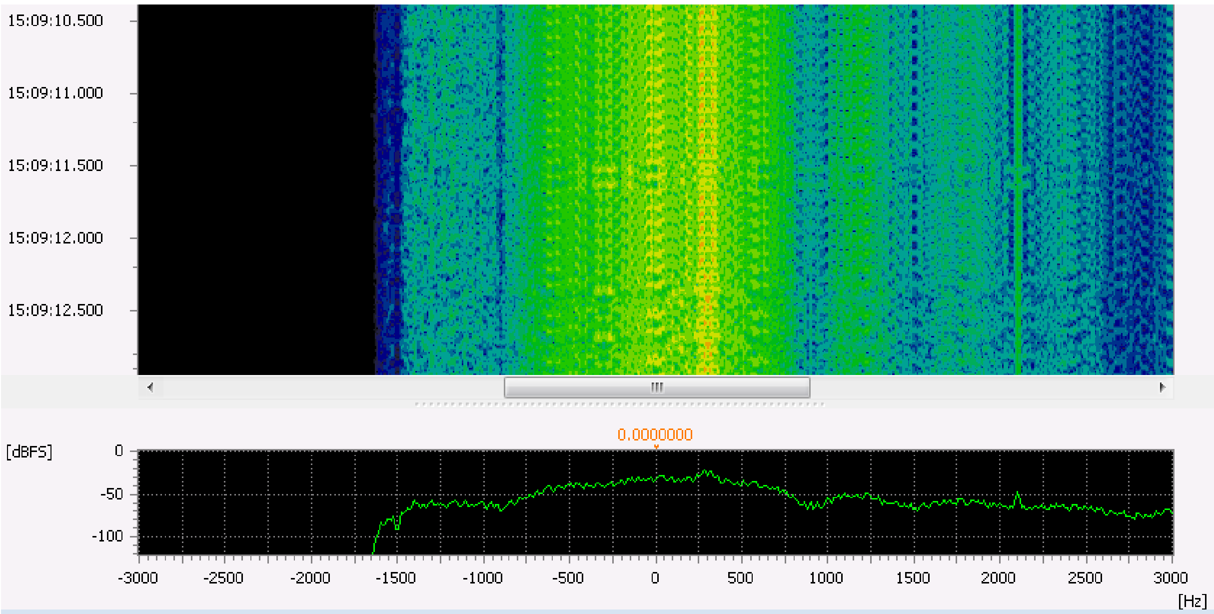


Figure 287: MPT1327 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK
Type	MSK
Symbol rate (Bd)	1200
SR tolerance (Bd)	5
Min. burst length (s)	0.010
Max. burst length (s)	60.000
Min. pause length (s)	0.010
VER file name	*Mpt1327_1200bd_msk.ver*

Table 349: MPT1327 Demodulator Settings

Tuning

- The tuning frequency is 1500 Hz above the low end of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 350: MPT1327 Features

Restriction

This decoder processes data on the TSC (Trunking System Controller) level only, not on the RU (Radio Unit) level.

NATEL

General Information

The NATEL SelCal standard was defined by the Scandinavian National Telephone.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 351: NATEL Characteristics

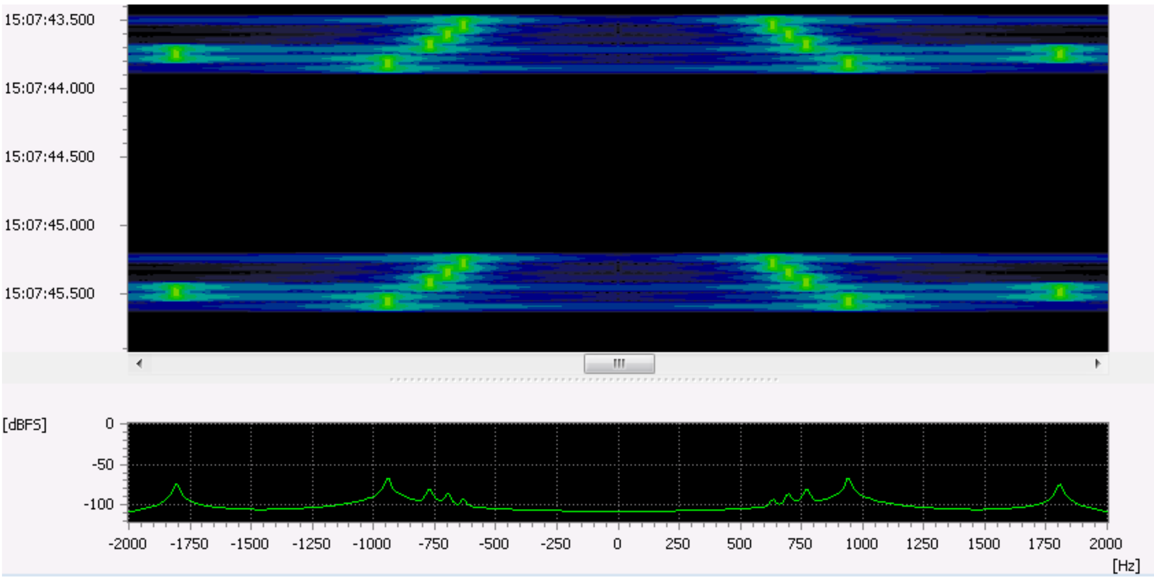


Figure 288: NATEL Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	70
TD tolerance (ms)	15
No. of tones	16
SELCAL type	NATEL
Min. burst length (s)	0.280
Max. burst length (s)	1.000
Min. pause length (s)	0.070
Min. burst SNR (dB)	3
VER file name	*natel.ver*

Table 352: NATEL Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 353: NATEL Features

NMT450

General Information

The **N**ordic **M**obile **T**elephone standard NMT-450 is an analog mobile telephone system developed by Telecommunications Administrations of Denmark, Finland, Norway and Sweden.

Usage:

- Public mobile phone network on UHF (450 MHz, 900 MHz with some restrictions).

Mode Properties

Parameter	Value
Modulation	FFSK
Shift (Hz)	600
Symbol rate (Bd)	1200
Coding	Convolutional FEC

Table 354: NMT450 Characteristics

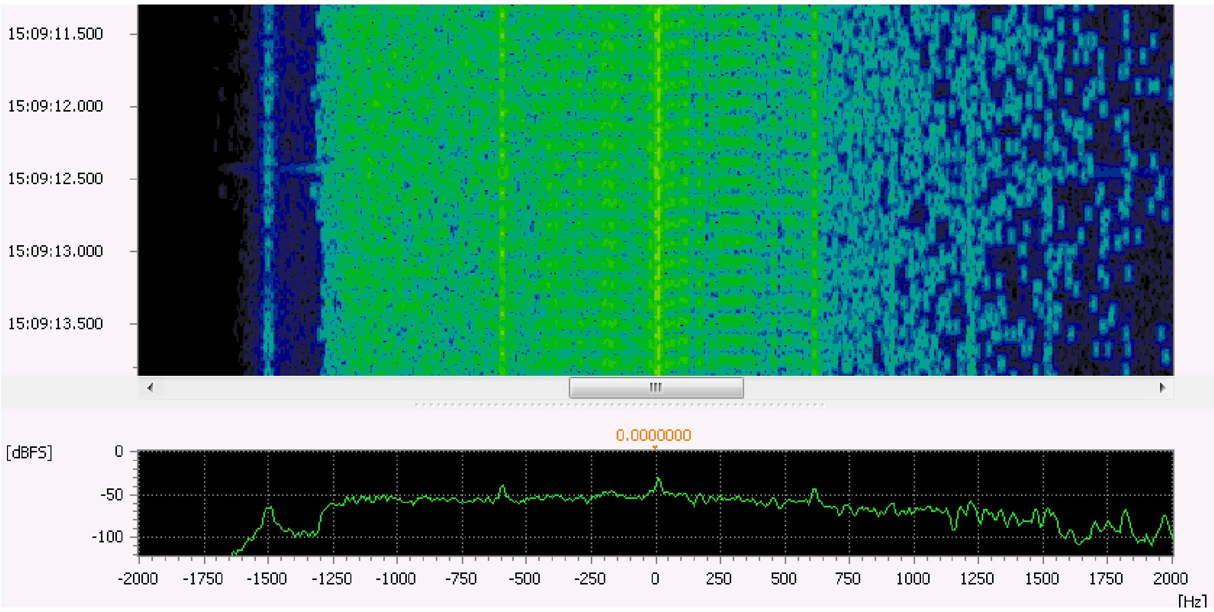


Figure 289: NMT450 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK
Type	MSK
Symbol rate (Bd)	1200
SR tolerance (Bd)	100
VER file name	*nmt450.ver*

Table 355: NMT450 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 356: NMT450 Features

POCSAG

General Information

The **P**ost **O**ffice **C**ode **S**tandard **A**dvisory **G**roup (POCSAG) pager defines the format used to encode messages and the standards for message transmission.

Usage:

- Pager in the VHF/UHF frequency range used by PTT administrations.

Mode Properties

Parameter	Value
Modulation	FFSK
Number of tones	2
Symbol rate (Bd)	512 / 1200 / 2400
Coding	BCH(31,21)
Alphabet	ITA-5

Table 357: POCSAG Characteristics

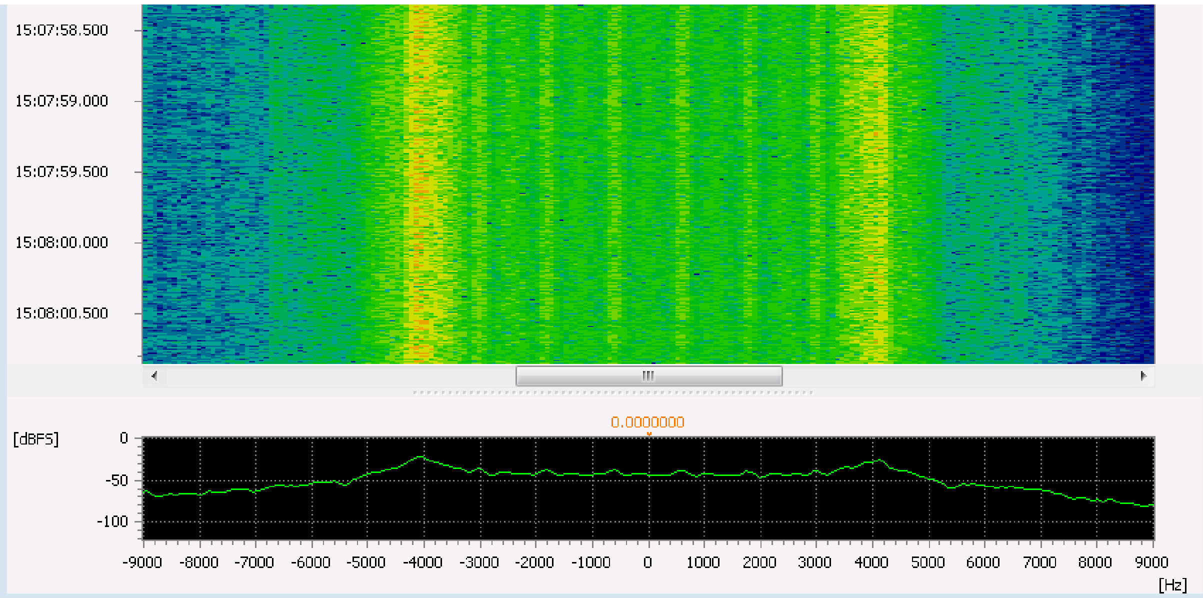


Figure 290: POCSAG Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	FSK2 matched
Symbol rate (Bd)	1200
SR tolerance (Bd)	5
Shift (Hz)	8500
Shift tolerance (Hz)	500
Modem type	Synchronous
VER file name	*pocsag_1200bd.ver*

Table 358: POCSAG Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 359: POCSAG Features

TETRA

General Information

TErrestrial **TR**unked r**A**dio (TETRA) is a standard for digital voice and data mobile communication over radio. The standard has been released by ETSI organisation. More than 100 countries across Europe, Middle East, Africa, Asia Pacific, Caribbean and Latin America are using TETRA systems. The standard is being updated and extended continuously by ETSI.

Usage:

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation.

Mode Properties

Parameter	Value
Modulation	DQPSK
Bandwidth (Hz)	25000
Symbol rate (Bd)	18000
Coding	FEC, encryption

Table 360: TETRA Characteristics

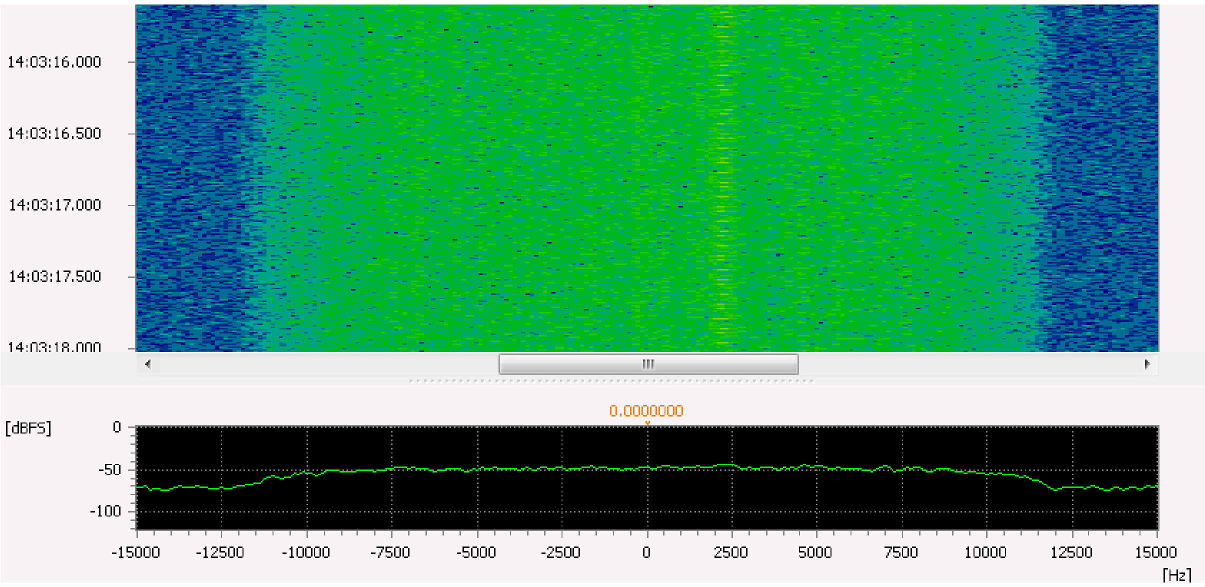


Figure 291: TETRA Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8 A/B
Symbol rate (Bd)	18000
SR tolerance (Bd)	10
Modulation order	4
Version	B
VER file name	*tetra.ver*

Table 361: TETRA Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Right now the modem does process only downlink signals.

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	yes
Combination with other modems (modem list)	yes

Table 362: TETRA Features

Tetrapol

General Information

Tetrapol is a digital professional mobile radio standard for digital voice and data communication. The standard has been designed by Matra and EADS corporation. Currently Tetrapol networks exist in 34 countries claiming about 70% of the European Digital PMR (Professional Mobile Radio) market.

Usage:

- Communication in the VHF/UHF frequency range among closed user groups such as public safety, military, industry and transportation.

Mode Properties

Parameter	Value
Modulation	GMSK
BT	0.25
Bandwidth (Hz)	12500
Symbol rate (Bd)	8000
Coding	FEC, encryption

Table 363: Tetrapol Characteristics

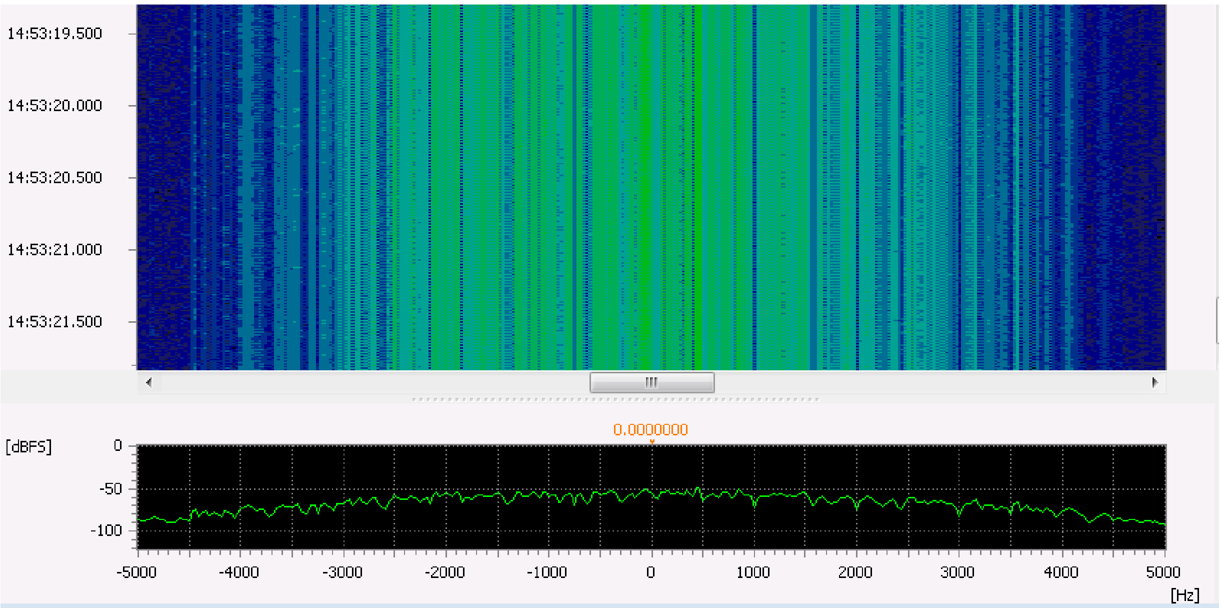


Figure 292: Tetrapol Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	(G)MSK
Type	GMSK
Symbol rate (Bd)	8000
SR tolerance (Bd)	10
BT	0.25
VER file name	*tetrapol.ver*

Table 364: Tetrapol Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	no
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 365: Tetrapol Features

VDEW

General Information

This SelCal system conforms to the VDEW (**V**ereinigung **D**eutscher **E**lektrizitaets**w**erke) recommendations (Germany). It is an analog SelCal system using a sequence of single tones.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	12
Coding	Character coding

Table 366: VDEW Characteristics

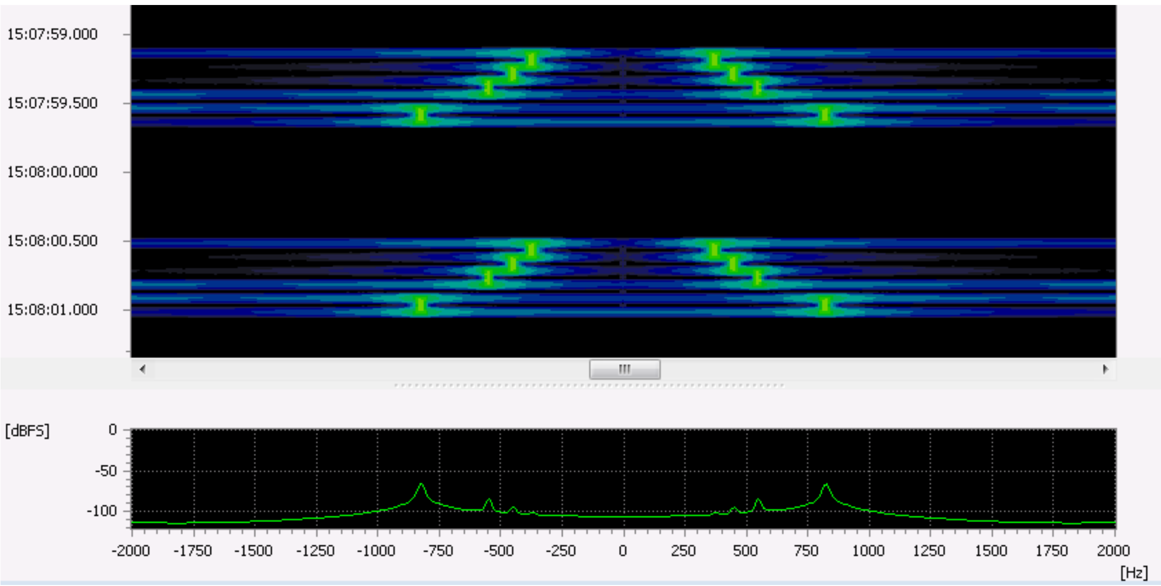


Figure 293: VDEW Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	100
TD tolerance (ms)	10
No. of tones	12
SELCAL type	VDEW
Min. burst length (s)	0.300
Max. burst length (s)	1.000
Min. pause length (s)	0.100
Min. burst SNR (dB)	0
VER file name	*vdew.ver*

Table 367: VDEW Demodulator Settings

Tuning

- The tuning frequency is the center of the signal’s frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 368: VDEW Features

VDL 2

General Information

The **V**HF **D**igital **L**ink (VDL) Mode **2** is an ICAO standard developed by the Aeronautical Mobile Communications Panel (AMCP) providing data communication between aircraft and ground-based systems. Aeronautical VHF data links use the band 117.975 - 137 MHz assigned by the International Telecommunication Union.

Usage:

- Data communication within the Aeronautical Telecommunication Network.

Mode Properties

Parameter	Value
Modulation	DPSK
Number of tones	8
Bandwidth (Hz)	25000
Symbol rate (Bd)	105000
Coding	Reed Solomon

Table 369: VDL 2 Characteristics

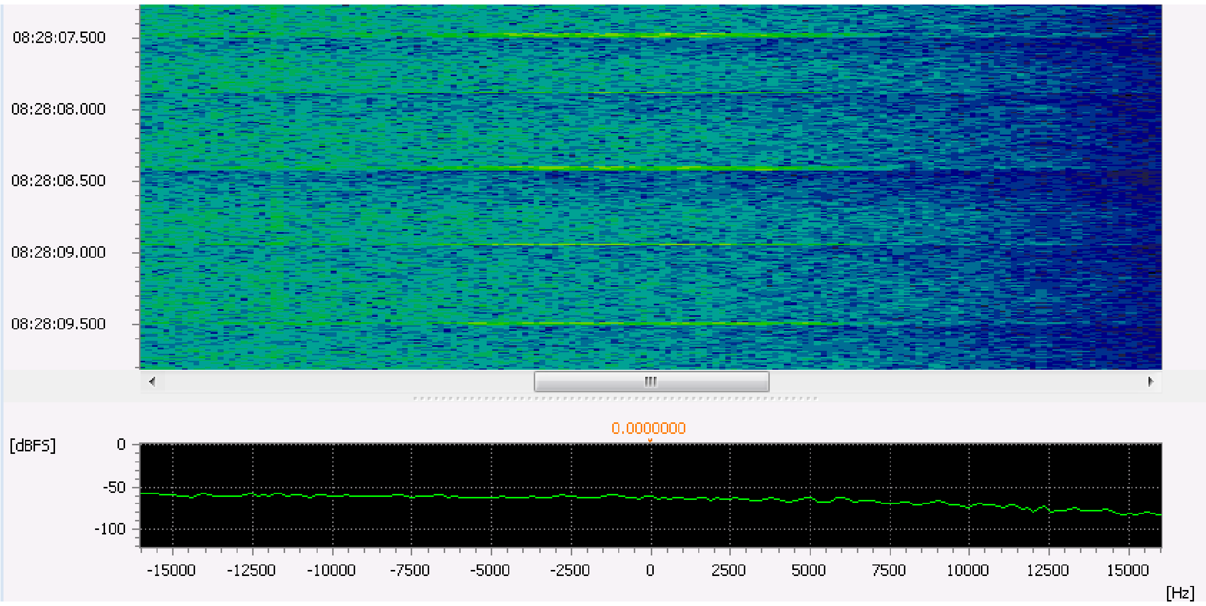


Figure 294: VDL 2 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8 A/B
Symbol rate (Bd)	10500
SR tolerance (Bd)	10
Modulation order	8
Version	A
Min. burst length (s)	0.003
Max. burst length (s)	1.000
Min. pause length (s)	0.001
Min. burst SNR (dB)	6
VER file name	*vdl2.ver*

Table 370: VDL 2 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 371: VDL 2 Features

VDL 3

General Information

The **V**HF **D**igital **L**ink (VDL) Mode **3** is an ICAO standard providing data and digitized voice communication between aircraft and ground-based systems. Ground stations assign Time Division Multiple Access (TDMA) slots for the exchange of information.

Usage:

- Data and digitized voice communication within the Aeronautical Telecommunication Network.

Mode Properties

Parameter	Value
Modulation	DPSK
Number of tones	8
Bandwidth (Hz)	25000
Symbol rate (Bd)	105000
Coding	Reed Solomon

Table 372: VDL 3 Characteristics

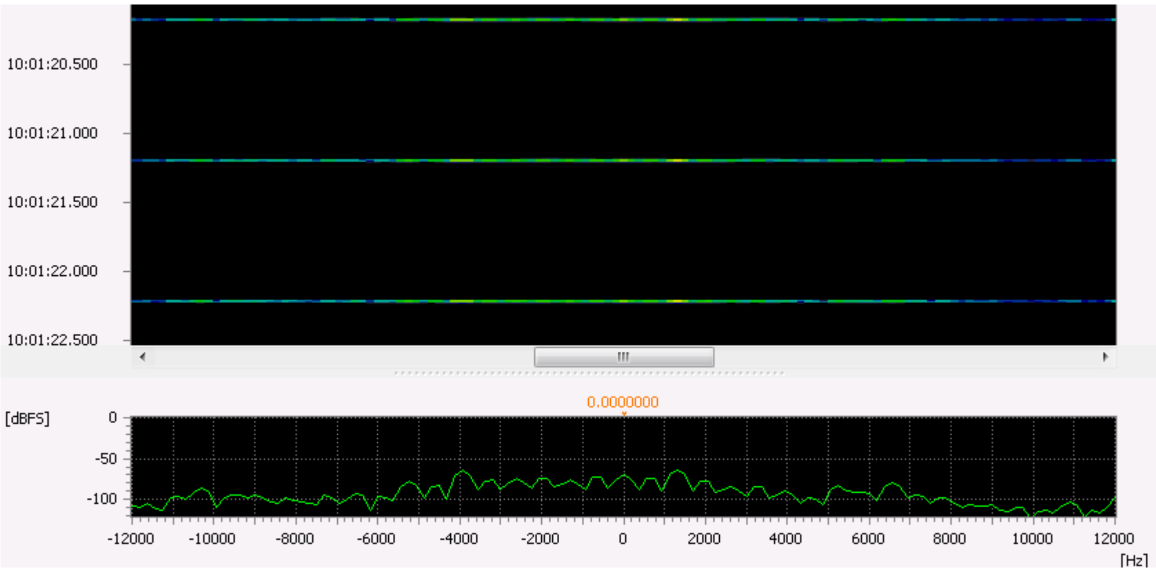


Figure 295: VDL 3 Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	DPSK 2,4,8 A/B
Symbol rate (Bd)	10500
SR tolerance (Bd)	10
Modulation order	8
Version	A
Min. burst length (s)	0.010
Max. burst length (s)	1.000
Min. pause length (s)	0.010

Parameter	Default
Min. burst SNR (dB)	0
VER file name	*vdl3.ver*

Table 373: VDL 3 Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 374: VDL 3 Features

ZVEI

General Information

This is a SelCal standard from the **Z**entral**v**erband der **E**lectrotechnischen **I**ndustrie, Germany. ZVEI I, ZVEI II, ZVEI III, DZVEI, PDZVEI and PZVEI vary only in the digit encoding.

Usage:

- Narrowband FM SelCal system in the VHF/UHF frequency range.

Mode Properties

Parameter	Value
Modulation	Multitone
Number of tones	16
Coding	Character coding

Table 375: ZVEI Characteristics

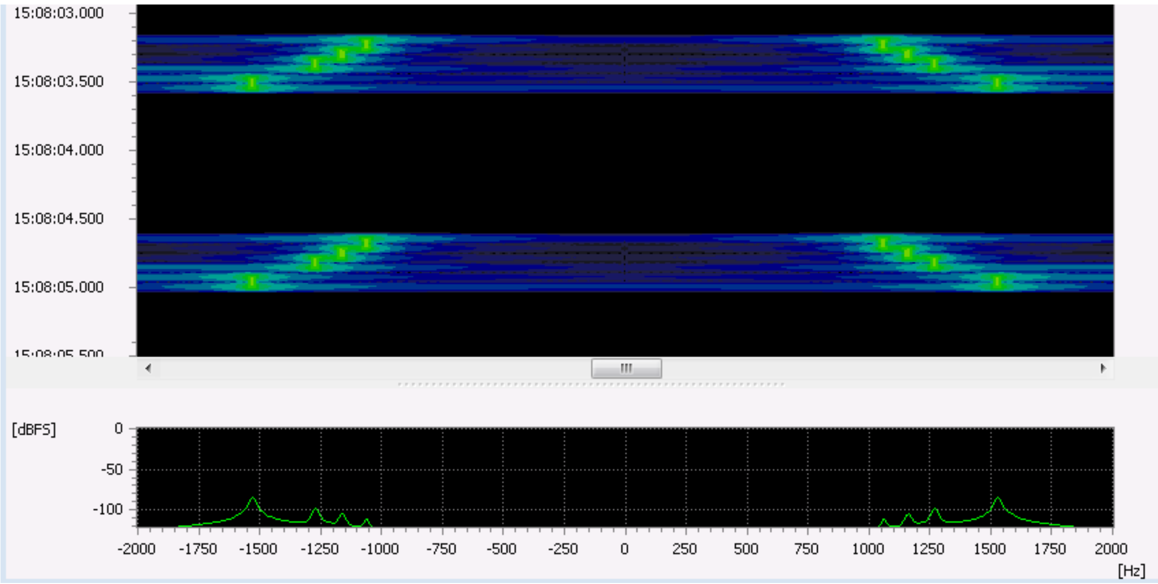


Figure 296: ZVEI Spectrogram

Demodulator Settings

Parameter	Default
Demodulator	Analogue Selcall
Tone duration (ms)	70
TD tolerance (ms)	15
No. of tones	19
SELCAL type	ZVEI
Min. burst length (s)	0.280
Max. burst length (s)	1.000
Min. pause length (s)	0.070
Min. burst SNR (dB)	0
VER file name	*zvei.ver*

Table 376: ZVEI Demodulator Settings

Tuning

- The tuning frequency is the center of the signal's frequency range.

Status

Feature	Status
Demodulation	yes
Recognition	yes
Decoding	yes
Automatic Polarity Adjustment	no
Combination with other modems (modem list)	yes

Table 377: ZVEI Features

go2DECODE

Appendix

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Bug reporting

Please report to: support@go2signals.ch

Required Information:

- Operating system
- Other Applications running
- Langauge of the operating system
- Screen Shot
- When did show up this problem for the first time?

Conditions of sale

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These general conditions of sales are binding if no other conditions have been declared as applicable in the offer or the confirmation of PLATH AG. Customer orders are binding only if PLATH AG has confirmed them in writing. These general conditions of sales are valid from September 1st 2012.

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The delivery time is specified in the confirmation of order/contract. The delivery time may be extended due to unforeseen circumstances such as acts of God (epidemic, earthquake, etc.), war, as well as delivery delays from our suppliers.

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The method of dispatch may be selected by the customer. Without any shipping instructions from the customer, we reserve us the right to arrange the dispatch by any forwarder or courier of our choice. Any complaints regarding damage, delays or loss must be forwarded to PLATH AG in written form within 48h from the receipt of the goods.

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The return of defect goods requires written approval of PLATH AG before the dispatch. The charges for the shipping costs must be paid by the customer. During the warranty period, PLATH AG will bear the expenses for shipping the item(s) back to the customer. The customer is responsible for returning the goods to the supplier without them being damaged, please use appropriate packing material and insure the goods.

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- reimburse the amount of the purchase price and terminate the contract
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Glossary of Terms

AF

Audio **F**requency 40 … 20000 Hz

Audio **F**requency is the range of acoustic waves which the human can perceive, in contrast to ultrasonic waves, which humans cannot hear.

ALE

Automatic Link Establishment, commonly known as ALE, is the worldwide de facto standard for digitally initiating and sustaining HF radio communications. ALE is a feature in an HF communications radio transceiver system that enables the radio station to make contact, or initiate a link between itself and another HF radio station or network of stations. The purpose is to provide a reliable rapid method of calling and connecting during constantly changing HF ionospheric propagation, reception interference, and shared spectrum use of busy or congested HF channels.

ARQ

The **Automatic Repeat reQuest** protocol **ARQ** is a method to increase the reliability of data-transfer. The data to transfer is split into smaller packets, each packet is extended by a packet-number and a checksum. On the receiving side a checksum is generated on the received data-part of the packet and compared to the checksum that was sent. If they do not concur, the receiving station sends a message to the originator of the message, reporting which packet failed. This message prompts the originator to send the indicated packet another time.

ASCII

The **American Standard Code for Information Interchange** commonly known as **ASCII** is a character-encoding scheme originally based on the English alphabet. ASCII codes represent text in computers, communications equipment, and other devices that use text.

ASCII evolved from telegraphic codes. Its first commercial use was as a seven-bit code for teleprinting promoted by Bell data services.
ASCII includes definitions for 128 characters: 33 are non-printing control characters (many now obsolete) for formatting and 95 printable characters, both upper and lower case.

Signals consist of 1 start bit, 7 or 8 data bits, 1 or 2 stop bit and optionally a parity bit, thus each character consists of a total of 9, 10 or 11 bits.

BCH

In coding theory the **BCH codes** form a class of parameterized error-correcting codes. BCH codes were invented in 1959 by Hocquenghem, and independently in 1960 by Bose and Ray-Chaudhuri. The acronym BCH comprises the initials of these inventors' names.

Reed–Solomon codes, which are BCH codes, are used in applications such as satellite communications, compact disc players, DVDs, disk drives, and two-dimensional bar codes.

In technical terms a BCH code is a multilevel cyclic variable-length digital error-correcting code used to correct multiple random error patterns. BCH codes may also be used with multilevel phase-shift keying whenever the number of levels is a prime number or a power of a prime number. A BCH code in 11 levels has been used to represent the 10 decimal digits plus a sign digit.

Context menu

A context menu (also called contextual, shortcut, popup or pop-up menu) is a menu in a graphical user interface (GUI) that appears upon user interaction, such as a right-click mouse operation. A context menu offers a limited set of choices that are available in the current state, or context, of the operating system or application. Usually the available choices are actions related to the selected object.

dB

Decibel (Symbol: dB) is a logarithmic unit that indicates ratio or gain. Decibel is used to indicate the level of acoustic or electromagnetic waves or electronic signals. The logarithmic scale can characterize very big or very small numbers with short notation. The dB level can be viewed as relative gain or attenuation of one level vs. a second, or absolute logarithmic scale level for well known reference levels.

Decibel is a dimensionless unit.

The ratio in Bel is the base 10 logarithm of the ratio of P1 to P0:

Ratio (dB) $= 10*\log_{10}(P1 / P0)$

DDC

In digital signal processing, a **D**igital **D**own-**C**onverter converts a digitized real signal centered at an intermediate frequency to a baseband complex signal centered at zero frequency. In addition to down-conversion, DDC’s typically decimate signals to a lower sampling rate.

DDL

The **D**ecoder **D**escription **L**anguage is a programming language developed by Procitec for the easy implementation of modems. A compiler converts the source-code into binary intermediate code, which is interpreted by the application.

DHCP

The Dynamic Host Configuration Protocol (DHCP) is a network protocol used to configure devices that are connected to a network (known as hosts) so they can communicate on that network using the Internet Protocol (IP). It involves clients and a server operating in a client-server model.

FEC

The **F**orward **E**rror-**C**orrecting code is a method to increase the reliability of data-exchange. Additional data is appended to the original data which can be used to correct data if they are partly corrupted. This technique is applied in cases where there is no channel for back-reporting, e.g. in a broadcast situation. It is used as well in situations where the switch-over and retransmission time by far exceeds the time to generate, transfer and evaluate the correction code (deep space communication).

FFT

The **F**ast **F**ourier **T**ransformation is a variant of the Fourier transformation. This is a method to convert data between time- and frequency-domain. Data are sampled in the time-domain, in many applications they are transformed into the frequency-domain for further processing.

The DFT is the discrete variant of the Fourier transformation. It works with every integer number N of samples and requires N^2 operations. The FFT is a special variant, where N is 2^m, m being an integer. In this case only $N*\log_N$ operations are required, accelerating processing significantly for larger N.

HF

High **F**requency 3 … 30 MHz

This is the frequency range for world-wide information-transfer over radio with low bandwidth. Propagation in this range is marked by reflections of the waves in the ionosphere, a layer which encloses planet earth at a high of about 60 to 600 kilometers. This way almost every 2 points on earth can exchange information sometimes within 24 hours, either by ground wave or via reflected waves. The ionization depends heavily on the solar radiation, so the available propagation-paths are a function of the time of the day.

I/Q

I/Q data are signals represented in the complex plane by their **I**nphase and **Q**uadrature parts. While the sole amplitude information of a signal is ambiguous regarding the phase, the combination of I and Q data identifies the phase positively. The magnitude of an I/Q signal is the square-root of $(I^2 + Q^2)$, the phase is arcsin(I) plus the quadrant information derived from Q.

LF

Low **F**requency 30 … 500 kHz

This is the frequency range for medium-range information-transfer over radio with low bandwidth. Propagation in this case is restricted to ground-waves, so the coverage is limited to a few 100 kilometers.

Modem

Modem is an abbreviation for **mo**dulator / **dem**odulator. It characterizes a device which is used to transfer information over radio, telephone- or fiberglass-line. The information which is to be sent is adapted to the channel so that it can be retrieived as reliable as possible, given the characteristics of the channel.

RCM

Receiver Control Modul (receiver.exe)

SLEW

Link11 is a NATO standard exchange of for tactical data over radio. **S**ingle Tone **L**ink **E**leven **W**aveform is a variant with extended data protection by interleaving and convolutional block coding.

SNR

Signal-to-noise ratio (often abbreviated SNR or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. It is defined as the ratio of signal power to the noise power. A ratio higher than 1:1 indicates more signal than noise. Normally the values are indicated in dB.

UHF

Ultra **H**igh **F**requency 0.3 … 3 GHz

This is the frequency band for information-transfer with high bandwidth. Due to the quasi-optical wave propagation the range is limited to about 10 kilometers for omnidirectional antenna systems, and to line-of-sight links in case of directional antennas.

VHF

Very **H**igh **F**requency 30 … 300 MHz

This is the frequency range for information-transfer with medium bandwidth. Due to the more or less quasi-optical wave propagation the range is limited to some 10 kilometers for omnidirectional antenna systems, and to close to line-of-sight links in case of directional antennas.

XSLT

XSLT (Extensible Stylesheet Language Transformations) is a language for transforming XML documents into other XML documents, or other objects such as HTML for web pages etc.,

The original document is not changed; rather, a new document is created based on the content of an existing one.

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